INDUSTRY INSIGHT

buildingSMART International

What do Facility Managers need from BIM?

Case 1: Cleaning Airports

A perspective from the Building Room

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1. Introduction

Airports are continuously challenged to rationalise their operations spending without undermining the guest experience. One such operational dimension that represents a significant investment is in maintaining airport cleanliness.

The key objective of this whitepaper is to develop a standardised information requirements protocol for use in the operational management of airport cleaning activities, through which accurate data and information are continuously gathered across all phases of the Asset Life Cycle. This additional information opens new possibilities to enhance decision-making processes, optimise cleaning activities, reduce costs, and improve the overall guest experience. In addition to creating a snapshot of the current situation in airports operational management, standardised data, and a common understanding of the best practice use cases will provide Facility Manager's with deeper insights by having a standard set of cleaning specific data requirements that can be used for making confident value-adding decisions.

With an understanding that cleanliness is a crucial driver of guest satisfaction, we can ask ourselves the following questions:

1. Are there any specific information requirements that can help the optimisation of the cleaning operation?
2. Can we improve the level of guest satisfaction through the usage of actual and uniform data & information? In addition, what data and information do Airports need to archive this, and in which stage in the FM-process or Asset life cycle phase?
3. Can we improve the overall satisfaction levels by optimising the project operational requirements and making surface material selections based on proven data related to cleanliness?
4. What is the average spend on cleaning services and cleaning practices? Can we relate the usage expenditure of spaces/zones through the building management systems (for example, lighting switching based on the presence of guests) by linking FM systems and other data & information systems?
5. As well as knowing how much is spent on cleaning, identification of what has been cleaned and when is also important.

In this document, we will describe how the use of open standards can contribute to answering these questions and how the ISO standards of Asset Management, Facility Management and Building Information Modelling can reinforce and complement each other. In addition, we will describe various use cases that highlight the added value uniform information requirement for FM processes embodied in the ISO41000 can bring to an organisation.

2. Vision

Building Information Models (BIM) have been used in design and digital construction for many years; however, they remain a new concept in facility management and owner operation applications. Therefore, Building Information Modelling (BIM) practices and terminology are being redefined to be able to use the BIM (data and information) created during the design and construction phase, in the Operational phase as part of Facility Management workflows. This presents a long-term opportunity and the need for a roadmap that promotes interoperability of the current FM applications with the IFC standard.

That being the case, "What do FMs need from BIM?" introduces new opportunities for the optimalisation for the Facility Management operation of cleaning Airports.

The use of building information models for facility management has led to discussion on an international level. A significant part of building information created in the early phases of the BIM process is relevant for the entire lifecycle of the building, including the operational phase. In the context of ISO19650, a verified as-built BIM model of what has been constructed forms the PIM (Project Information Model) and from which relevant information is used to form, or be merged into, an existing Asset Information Model. An Asset Information Model should gradually mature alongside the information needs for the facility management processes, and more airports are spearheading their adoption.

Building Information Models should be verified as-built during construction to ensure that the information is accurate and meets the operational information needs of the Airport client[1]. Doing so increases the value of BIM in the post-construction phase as relevant information such as surface and material information for cleaning can be used within an Airport's Asset Information Model for use in the operational phase to give a more detailed understanding of the building and use data analytics to optimise asset performance.

Airport Asset Management System's typically involve multiple systems, software, and databases, meaning there isn't just one tool that can accommodate all airport's use cases. Instead, the airport technology environment is best treated as an ecosystem, where components can be added, removed, or changed without impacting the overall system. Also, data must be able to move effectively between systems, thus making it essential that data can be exchanged in open formats.

openBIM standards such as Industry Foundation Classes (IFC) and Model View Definition (MVD) are established as open global standards for interoperable information transfer in digital construction projects. These standards are increasingly being used in the handover/ delivery of architectural and installation engineering information for the operative maintenance phase. Enhancing openBIM standards based on FM-relevant use cases and the associated information requirements can help accelerate the merging of BIM into the operational facility management processes and bring clarity to the specific information needs.

Sustainable, accessible, and intelligent FM environments consist of an extensive portfolio task. Therefore, it is a welcoming challenge for the digital transformation of the FM framework to accommodate everything within the building portfolio in a single digital entity across multiple digital platforms. Furthermore, there an ample opportunity to innovate traditional FM-work processes through the digitisation [2]of the as-is data, geometry and documentation required and the digitalisation[3] of work processes to be standardised.

This whitepaper aims to clarify why Airport organisations should adopt openBIM as a tactical tool in their data strategy to help enhance daily management of operational and facility management activities. BIM is traditionally used for creating physical Airport facilities. However, there is a lot of potential to continue updating the models with relevant FM attribute data for proactive maintenance purposes and optimising lifecycle management. Also, the use of openBIM regarding FM is an important factor for the passenger and guest journey.

[1] Construction BIMs can be verified as "as-built" through on-site survey using visual verification, laser-scanning, or traditional measuring. Final installed material selections should also be updated within the BIM or an associated database.

[2] Digitisation is the transition of information into a digital form, i.e. into a form that can be used by electronic devices such as computers.

[3] Digitalisation is the use of digital technologies to change a business model, provide new revenue and value creation opportunities; it is the process towards a digital business (towards digital FM processes).

In short, to create as much value as possible by applying digital technologies.

3. Relations between the different ISO standards around information requirements

3.1 What does the ISO41001 standard say about information requirements?

The ISO41001 standard includes a chapter that discusses FM information and data requirements (chapter 7.5.4, as well as appendix A.7.5.4). It states that the organisation shall determine its information requirements to support its FM system and the achievement of its organisational objectives. Furthermore, it states that the organisation should consider its FM information and data requirements related to the following areas:

- Facility asset characteristics (e.g., ownership, design parameters, vendor information, physical location, condition, in-service dates, materials)
- Service delivery and operations including maintenance management (e.g., historical failures, betterment or replacement dates, future maintenance requirements)
- Financial and resource management issues (e.g., historical cost, replacement value, date of acquisition, materiality, life cycle cost analysis, useful service lives)
- Asset management

This whitepaper will use these recommendations as guidelines when considering the information requirements of FM providers.

3.2 What does the ISO55000, Asset Management, says about Information requirements?

This standard also specifies that the organisation shall determine its information requirements to support its assets, asset management, asset management system and the achievement of its organisational objectives. In doing this:

a) the organisation shall include consideration of the significance of the identified risks, the roles and responsibilities for asset management;

- the organisation should consider their asset management processes, procedures and activities;
- define the exchange of information with its stakeholders, including service providers;
- the impact of quality, availability and management of information on organisational decision making;

b) the organisation shall determine:

- the attribute requirements of identified information;
- the quality requirements of identified information;
- how and when information is to be collected, analysed and evaluated;

c) the organisation shall specify, implement and maintain processes for managing its information;

d) the organisation shall determine the requirements for alignment of financial and non-financial terminology relevant to asset management throughout the organisation;

e) the organisation shall ensure that there is consistency and traceability between the financial and technical data and other relevant non-financial data, to the extent required to meet its legal and regulatory requirements while considering its stakeholders' requirements and organisational objectives.

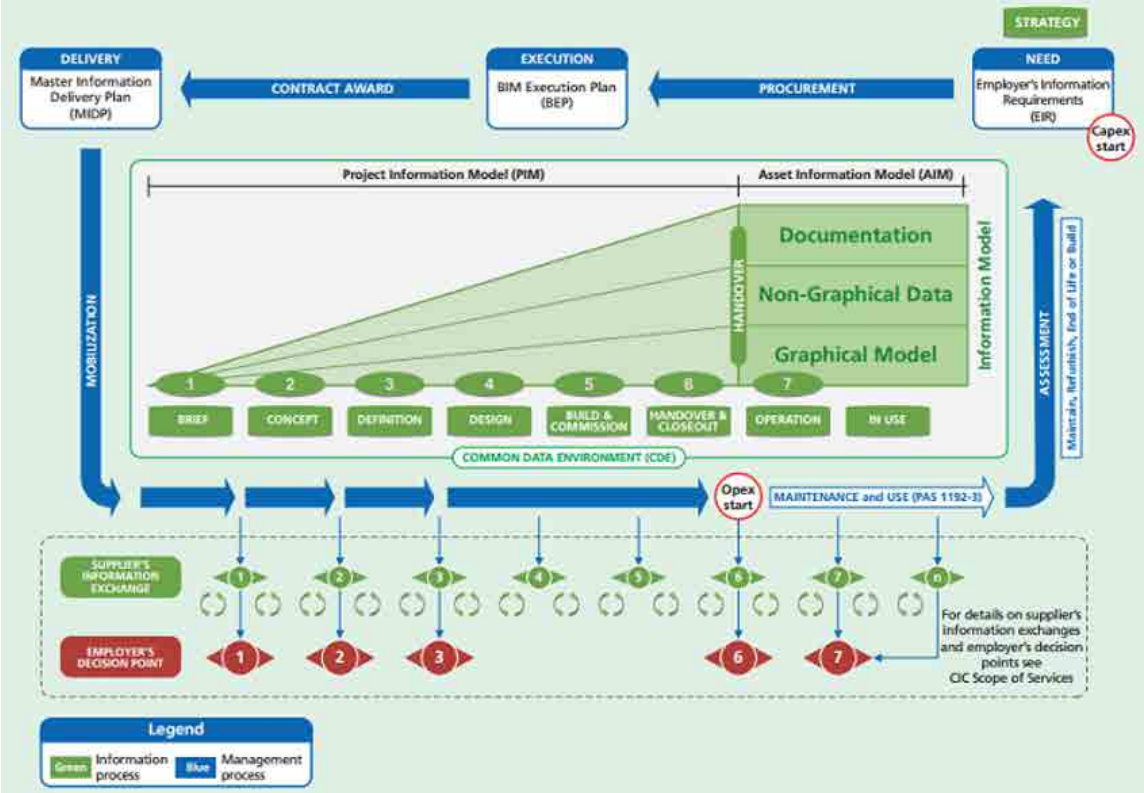
3.3 ISO19650 series

This series sets out the recommended concepts and principles for business processes across the built environment sector in support of the management and production of information during the life cycle of built assets (referred to as "information management") when using building information modelling (BIM).

These processes can deliver beneficial business outcomes to asset owners/operators, clients, their supply chains, and those involved in project funding, including an increase of opportunity, reduction of risk and reduction of cost through the production and use of asset and project information models.

The series also stated that it is necessary to determine and define all the information requirements for your organisational processes so they can work efficiently and base their decisions on actual and verified information.

In addition to the need for defining all of the information needs, it is clear that the fulfilment of the information requirements develops incrementally as the project progresses through each phase of the asset lifecycle, as shown in the schema below.



3.4 Conclusion

In the Facility Management and Asset Management standards, it is clearly stated that defining the information requirements for all stages in their processes is essential.

In the BIM standards, it is explained how you can use those defined information requirements in the creation of new assets through the use of BIM working methods and openBIM (data) standards and maintain control over the data and information delivery during these phases so that they can add the expected value in your FM and Asset Management operational phases.

Therefore, OpenBIM data & information flows can help FM companies further enhance the different core processes recommended by ISO41001. In addition, it can help evaluate risks related to the facility, strengthen support processes, reduce operational costs, and create more accurate and data-driven evaluation processes.

4. Similarities in the Information requirements for Asset information Models and the Facility Management cleaning operation

4.1 General

During discussions with the participants on creating this document, it became clear that all involved parties had some kind of document that specified their organisation's information requirements and build-up of it during the different phases.

For example, Schiphol Amsterdam Airport's information requirements for cleaning includes a structured build-up related to the various phases of its lifecycle.

However, this has not yet explicitly been defined and described in objects and related data requirements used for the Asset Information Model and the descriptions in open standards that can be used in the BIM working method for creating and validating information requirements for usage in the FM operation.

Therefore, the similarities between the Asset Management information requirements and the necessary information requirements for the FM cleaning process became more apparent. Also, specific FM information requirements are not consciously included nor delivered explicitly in the Asset Information Model during the delivery phase.

Here it becomes clear that the technical installation maintenance needs to support the operational processes at airports (often seen as Asset Management) are not yet sufficiently aware of the operational FM cleaning processes and the necessary information to be able to manage this efficiently and effectively.

4.2 Conclusion

The above observations make it clear that the uniform and integral description of information needs for both Asset Management and Facility Management will create value for Airports' asset management and FM processes.

5. Building Information Models in Proactive OPEX Budgeting of Cleaning Airports

Cleaning activities often make the highest expense of airport FM companies.

The complexity and the continuous renovations and adjustments of the commercial needs significantly impact the guest experience, especially the cleaning of these areas.

Also, these changes often bring additional costs due to poor communication about exact areas, but perhaps even more importantly, the changing realisation schedules.

By sharing information models uniformly across all construction, AM and FM processes, remarkable efficiency and cost savings can be achieved, but perhaps even more importantly, a better guest experience.

5.1 Conclusion

Cleaning of airports is everyday activity across all airport facilities worldwide. Therefore, rather than each operator developing their own information standard for cleaning areas, there is great efficiency to be gained by creating a shared and open standard, a standard that can be applied regardless of territory or software application used. Common and open data standards enable airport operators to focus on their core activities and accommodate the fact that many global consultancies and airport contractors are working across different airports. Working collectively to develop an information standard will bring clarity to the global supply chain, whether they are designing, constructing, servicing, or operating within an airport environment. Therefore, a uniform information requirements specification is needed.

Another key advantage of open standards is that they lower the barrier of entry for suppliers to provide consistent and reliable data, as they are achievable with a range of software applications, rather than needing to use specific proprietary software solutions. Information can be shared, so it remains integrally accessible and functional well into the future, giving certainty to clients that what they ask for today will be useful tomorrow.

6. Opportunities that arise from the uniform requirements, the retrieval of the data, linking and using it

6.1 Opportunities from linking dynamic data and BIM data

Airports-built asset consists of essential static infrastructure that hosts complex dynamic processes around the clock. The Airport structure and infrastructure must enable the orchestration of big passenger groups, advanced security regulations, movement of heavy machines, and so on.

This dynamic activity has a significant effect on the planning and operation of cleaning services. Analysing real-time data about the frequently used areas in the airports and the movement of the cleaning staff can help optimise these processes and, in addition to that, reduce the cleaning costs. For example, one could track the less frequently visited areas and reduce their cleaning activities with real-time data.

For this reason, installing equipment and systems for real-time data collection has been a standard for many years. Nevertheless, the dynamic data that building systems deliver is hard to obtain. When it is obtained, it is not (always) referenced with the correct location in the FMIS, making it hard to analyse.

Enhancing openBIM standards and processes with adequate BMS (Building Management Systems) referencing can help to ensure better information exchange and appropriate mapping between data points delivering real-time data and their locations. Furthermore, by enhancing IFC-terminology, creating a corresponding MVD, and focusing on use-case-based communication, facility managers can avoid studying complex building automation knowledge and rely on the information requirements to fulfil the desired use cases.

6.2 Combining static and dynamic data can help FM by:

6.3 Identifying high traffic areas that need more frequent cleaning

Based on the BIM model and linked dynamic data, a precise analysis of space utilisation in the facility can be supplied. Space utilisation analysis helps FM understand the spatial limitations and advantages of their managed assets. It can show areas of high utilisation, which might create a bottleneck for day-to-day operations and emergency cases. It can also display areas with low utilisation that should be redesigned for more critical processes. With spatial analysis, the combination of BIM and dynamic data can help FM establish a real-time understanding of what areas in the building have higher traffic and therefore need more frequent cleaning and maintenance.

Identifying areas where the cleaning crew spends more time.

- linking data from cleaning staff
- complex cleaning areas and materials

Determining the quickest route between designated cleaning areas.

- spatial route analysis
- people flow simulation

6.4 Integrating dynamic data and BIM/AIM data

The benefits of combining dynamic data with AIM/BIM data are immense, but the actual integration of BIM data with the BMS dynamic data is a complex engineering task. The data points delivering dynamic data are related to the electrical equipment of BMS systems or by IoT devices. These are often connected to the mechanical and electrical systems of the building (Air conditioning, heating and ventilation systems, lighting systems, etc.), helping to monitor and enhance their processes based on the desired use cases. Therefore, deciding about the use cases for the utilisation of automation systems should already be happening during the conception stage of the building. The task of combining BIM data and dynamic data should be formalised in the information requirements.

Leveraging the power of dynamic data and BIM data in Greenfield buildings

To achieve the best system utilisation, the FM, the BMS engineer, or an equivalent service provider must be involved in the early stages of the design and conception stage of the building. Then, together with the asset owner, they should agree on the relevant use cases of the building automation systems and ensure that the relevant data is listed in the Information requirements.

Leveraging the power of dynamic data and BIM data in Brownfield buildings

A significant part of the information about the building structure and BMS systems is lost in the handover processor remains in the hands of the engineering company assigned to the job. Nevertheless, integrating the dynamic data and BIM data in brownfield buildings can be done by re-engineering and digitising the managed assets.

Using openBIM to enable better interoperability

Enhancing openBIM standards and processes with adequate BMS (Building Management System) referencing can help to ensure better information exchange and appropriate mapping between data points and locations. By enhancing IFC-terminology, creating a corresponding MVD, and focusing on use case-based communication, facility managers can avoid studying complex engineering knowledge and rely on the information requirements to fulfil the desired use cases.

7. The Opportunities for FM openBIM Information requirement protocol, FM Information Delivery Manual, and the creation of a FM-AM Common Data Environment

7.1 Need for master (open) data & information

Operational and administrative systems also need to access the broader context of the BIM/FM information parts. See, for example, this link; Resource Location - content

Operational and administrative systems require updated master data about locations. It is necessary to introduce appropriate data standards, such as the GS1 GLN, to have shared concepts for locations in Airports across systems and organisational entities. This is needed for localisation and traceability. For example, associating technology needs to translate from an XYZ coordinate to a location-concept relevant for the actor consuming that information. Indoor XYZ alone is not meaningful.

7.2 Need for interoperability

There is a need for technical and semantic interoperability between AIM(BIM) and FM and between AIM+FM and the broader IT context of the Airport IoT landscape.

Moving IFC files around is insufficient for integrating FM operations and maintenance or such a broader context. (File-based integrations between systems is prohibited for many workplaces). OpenBIM needs to provide modern standardised–exchange specifications - or APIs - that provide access to relevant parts of BIM required for FM technology. The under-development standard for Linked data ISO 21597-1:2020 – information container for linked document delivery - could be a guideline for developing this.

7.3 Organisational flexibility

Airports manage and operate their properties. However, in the event of outsourcing FM, it would be essential to use standards. Actors operating a property should not impose (proprietary) standards on the wider organisation using the property.

7.4 FM Information requirement protocol, FM Information Delivery Manual

In order to truly achieve the advancement of openBIM standards for use in Airport environments, it will be necessary to specify and define an FM-information requirement protocol and an FM information delivery manual.

7.5 Conclusion

This paper sets out the importance of open data and interoperability to be easily used in the different processes within Airports. Of course, no airport has the same internal working processes, but the information need is predominately similar.

8. Implementation of the buildingSMART standards

This white paper will be translated in the second phase of this work in information requirements to implement the requirements in available supported information exchange standards provided by bSI.

At the time of writing this document, the following process is the one accepted and supported by the bSI community.

Any future standards and processes are also acceptable, assuming they are supported and available in the production state. The implementation should adhere to the documentation in ISO 16739-1:2018.

Supported: software provided by software vendors in the built asset industry are certified to use the standard and can exchange information with it.

Available: the standard is accepted by the community and can be developed by bSI community and the tools.

Acknowledgements

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