Facility management using Autodesk Tandem

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ABSTRACT:
This paper presents the possibilities of using the Autodesk Tandem platform, during the process of managing a construction facility. At the most mature stage of a building's life, i.e. operation, BIM becomes a methodology that can bring concrete benefits to individuals or organisations managing facilities. Currently in Poland, BIM is at an early stage of adoption. Facility managers are often unaware of the advantages of using BIM. With a 3D model saturated with information, effective management is possible, including planning repairs, maintenance or carrying out inspections. This paper summarises the advantages and benefits of using BIM from the perspective of a facility manager, in this case a residential, single-family, detached building with specific energy-saving solutions that require ongoing management and periodic inspection.

KEYWORDS:
BIM methodology; Autodesk Tandem; digital twin; facilities management

1. Introduction

The largest group of all expenses during the entire life cycle of a building is the operating costs. These can range from 70 to 80% of the total costs. Using BIM (Building Information Modelling) methodology can reduce these by up to 33% [1]. One way of doing this is to reduce repair and maintenance costs through access to information contained directly in the model (e.g. technical data, warranties, inspection dates, installation and operating instructions) [2]. *Facility management* activities depend on the timeliness and completeness of facility data created during the design and construction phases of a facility and are maintained during the operation and maintenance phase [3].

The facility manager's responsibilities include ensuring safety, timely inspections, ongoing maintenance, organising repairs and upgrading the building [4]. Using the Autodesk Tandem platform, the manager and other stakeholders do not need to have expensive software, specialist knowledge and powerful computer hardware [5]. This and other types of software use a BIM model as the basis for documenting the building and the equipment within it. The accessible form allows the manager to more effectively ensure the continued operation of the facility, its maintenance and the reduction of maintenance costs [6].

Autodesk Tandem is a cloud platform that supports the digital twin of a building [7]. It enables the management of the *Asset Information Model* (AIM), which contains management, maintenance

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and operational data in addition to the digital building model. Working on the platform supports the collaboration of owners, managers and project teams and helps to achieve the desired results. It provides quick access to the model, with the ability to work in a browser, whether on a computer or a mobile device. Autodesk Tandem offers three types of subscription plans (Table 1). The first is a free version, available for one year from the date of account creation. The next two plans are paid – the price of the classic version of Autodesk Tandem varies between USD 3000 and USD 510 000 (from ca. PLN 13 380 to PLN 2 274 600 according to the exchange rate of 12.12.22) for the number of *tagged assets* from 5000 to 850 000. Objects with data imported from the source are not included. Component occurrences or so-called entities (*assets*) consist of physical elements of the real world (e.g. walls, doors, equipment) and conceptual objects (e.g. spaces, rooms, zones).

Table 1
Possibilities for different subscription options [8]

	Autodesk Tandem Free	Autodesk Tandem	Autodesk Tandem Unlimited
Duration of subscription	1 year	1 year	lack of information
Number of entities to be managed	1000	5000-850 000	unlimited
Unlimited number of users	+	+	+
Unlimited number of objects	+	+	+
Unlimited number of objects	+	+	+
Revit model handling	+	+	+
Support for IFC models	+	+	+
Integration with Autodesk Docs	+	+	+
Management of views	+	+	+
Facility information management	+	+	+
Tracking the history of changes	+	+	+
Import/export to Excel	+	+	+
Sectoral categorisation	+	+	+
Parameter sets	+	+	+
Object templates	+	+	+

One of the many advantages of the platform is the ability to link to models and documents stored in the *Common Data Environment* (CDE). Autodesk Tandem also allows, exporting or importing statements to/from Microsoft Excel. Asset management is a fundamental task in the maintenance and upkeep processes of construction facilities. Thus, the aim of this article was to present the possibilities of using Autodesk Tandem in facilities management processes, mainly from the perspective of the resources provided with BIM projects.

2. Work environment

To create an account, go to: intandem.autodesk.com. Once access is granted, a brief description of the main tabs of the interface appears. One potential hindrance when working in the programme is the need to know basic English. The model navigation interface is in Polish, while all other elements are in English. In order to ensure adequate working comfort, it is possible to change the appearance of the interface – light or dark. An important element of the platform is the 'Manage' tab, where the user has control over various aspects of their account and the model's organisation requirements. In the 'Organisation' tab, it is possible to change the name of the organisation to which the user belongs, as well as to check the type of licence, its expiry date and the account ID. The ability to collaborate with other stakeholders is provided by the 'Team' tab, where other people's accounts need to be added and the type of authorisation set (Table 2).

Table 2
Opportunities for action on the platform for each type of entitlement

	Read	Edit	Manage	Account admin
Viewing the model	+	+	+	+
Modifying the model	–	+	+	+
Adding and editing new content	–	–	+	+
Inviting stakeholders	–	–	+	+
Edit user rights	–	–	–	+
Deletion of uploaded models	–	–	–	+

The 'Classification' tab is responsible for managing the classification systems used in user models. A classification system defines a hierarchical structure of categories and element types. These are used to define resource types and their grouping (or categorisation). Four system standards are available to the user – default (masterformat), uniform format, simple categories and uniclass. Each of these contains a different number of hierarchy levels, classification codes and category names. This depends on the needs of the selected industry. It is also possible to create your own classification system, depending on your needs.

3. Case study

In order to present the functionality of Autodesk Tandem, the perspective of the owner of a detached house with a specific energy-efficient design is taken. The property is contains equipment that requires management and control, hence the need to store all the necessary information in one place. The original model from bimobject.com was enhanced with additional equipment such as a heat pump, an electric car charger and a solar lamp.

Once the user account had been set up, work began with the creation of a new object under the 'Facilities' tab. The selection of an object template is used to initially link the classification system to the parameters. Its use helps to comply with industry standards or to meet specific project requirements. In this case, the default template "Sample Template - Simple Categories" was used. When a new file is opened, a brief description of the main tabs under "Facilities" appears (Table 3).

Table 3
The main tabs under the 'Facilities' tab, along with a description

Facilities tab	Description
filters	changing display settings (visibility of layers, categories, levels, etc.)
assets	selection of object template, classification system and parameters
files	import of models identified with the digital twin, their deletion, updating or deactivation of their visibility
docs	attach documents from Autodesk Docs and add them to specific elements using parameters
users	granting access to an object and granting rights to other users by the administrator/ manager

An input file in .rvt format was imported, while the other format supported was .ifc. In order to demonstrate the essence of the programme and its capabilities, a simplified building model was used, in which the location of the objects differs from the real one. The elements to be managed are solar panels, a heat pump, a solar lamp and an electric car charger (Fig. 1).
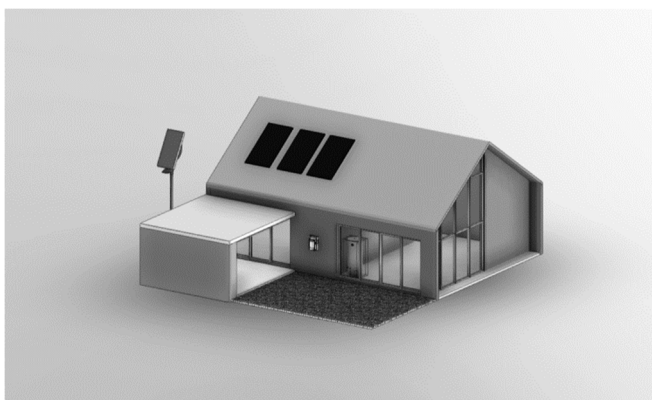
Fig. 1. Building model in Autodesk Tandem [9]

A key functionality is the ability to create and add custom parameters. Attaching them to entities requires the use of an appropriate classification and object template, which binds the industry categories to the parameter sets describing the model elements. One limitation is that it is necessary to create a custom object template – otherwise it is not possible to add parameters.

When defining parameters, a number of formats are available – numeric, integer, text (possibility to create your own drop-down list), date, yes/no, hyperlink. It is important to highlight the fact that it is possible to select units for each parameter depending on branch affiliation, i.e. plumbing, electrical, architecture. The disadvantage is the lack of notifications for time parameters, e.g. the end of guarantee date approaching. The default parameter library contains 132 parameters of different categories. In the case study presented here, 5 custom parameters were created (Table 4).

Table 4
Created parameters for selected components

Name	Category	Data type	Unit	Description	Permissible values	Link
Breakdown	all categories	yes/no	–	Does the device require repair?	–	element
End of warranty date	all categories	date/time	date	Date of end of manufacturer's warranty period	–	element
Operating instructions	all categories	link	–	Link to operating or assembly instructions	hyperlink	element
Rated power	electrics	number	power in W	Cell power under test conditions	–	element
Maintenance period	all categories	text	–	Period after which the appliance must be serviced	6 months 1 year 2 years 3 years 5 years	element

Under the 'Inventory' tab, a table of all occurrences in the model with attributes has been automatically generated. The tables can be exported to .xlsx format and used by other stakeholders. On the other hand, the 'Reports' tab shows the number of all entities in the model, the number of elements entered via the platform and the time since the last update.

One of the most practical functionalities is entity filtering in the 'Filters' tab. The default filters relate to source files, storeys, zones, assigned classification system, object code and also catego-ries from Revit. In the "Inventory" tab, it is possible to select entities entered in the programme

and export an automatically generated list taking into account the applied filters (Fig. 2). In the settings, it is possible to add further filters from an existing list or using the parameters created.
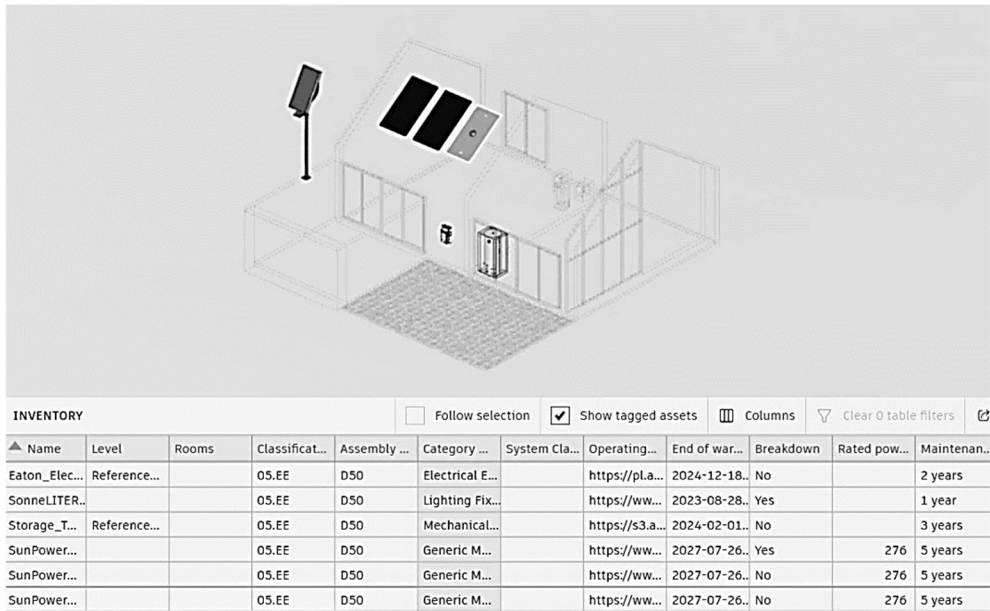

	Name	Level	Rooms	Classificat...	Assembly ...	Category ...	System Cla...	Operating...	End of war...	Breakdown	Rated pow...	Maintenan..
▲	Name	Level	Rooms	Classificat...	Assembly ...	Category ...	System Cla...	Operating...	End of war...	Breakdown	Rated pow...	Maintenan..
	Eaton_Elec...	Reference...		05.EE	D50	Electrical E...		https://pl.a...	2024-12-18..	No		2 years
	SonneLITER..			05.EE	D50	Lighting Fix...		https://ww...	2023-08-28..	Yes		1 year
	Storage_T...	Reference...		05.EE	D50	Mechanical...		https://s3.a...	2024-02-01..	No		3 years
	SunPower...			05.EE	D50	Generic M...		https://ww...	2027-07-26..	Yes	276	5 years
	SunPower...			05.EE	D50	Generic M...		https://ww...	2027-07-26..	No	276	5 years
	SunPower...			05.EE	D50	Generic M...		https://ww...	2027-07-26..	No	276	5 years

INVENTORY ☐ Follow selection ☑ Show tagged assets ▥ Columns ▽ Clear 0 table filters

Fig. 2. Summary of parameters for selected entities

There are 2 ways to visualise the filtering results:
- "Cluster by filter" – the model entities are grouped according to specific values of a given filter (Fig. 3);
- "Colour filters" – the model entities display in default or user-assigned colours depending on the value of the filter in question (Fig. 4).

It is a great convenience to combine several filters at the same time, e.g. grouping entities by Revit category with simultaneous presentation in colours according to the value of the failure occurrence parameter.
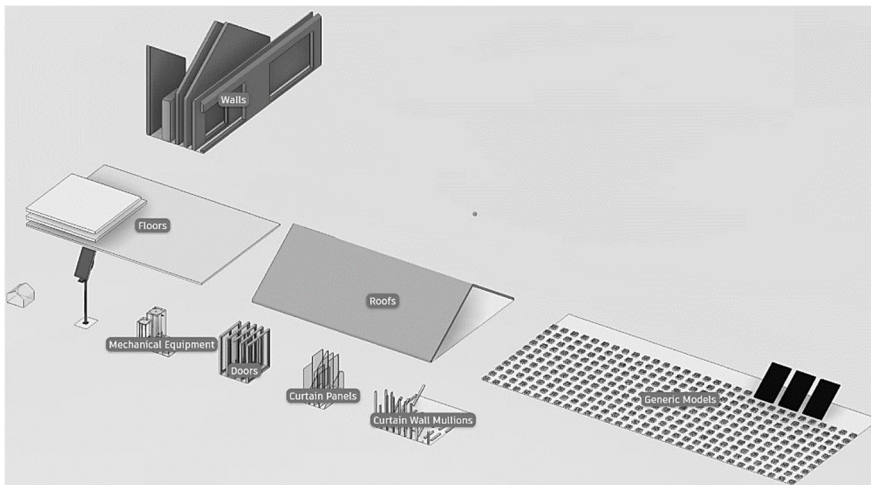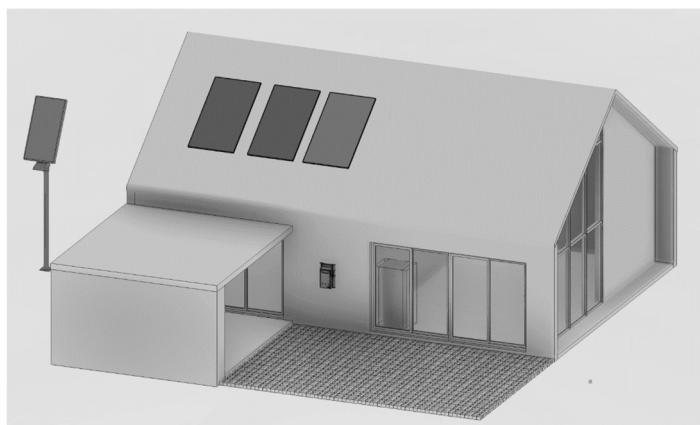

Fig. 3. Visualisation of filtering results using 'Cluster by Revit Categories'

Fig. 4. Visualisation of filtering results using 'Color filters' for the 'failure' parameter –
lighter grey colour for elements with failure (e.g. one of the PV panels)

4. Conclusion

An in-depth knowledge and understanding of BIM enables effective asset management from the 3D model [10]. The main benefit of integrating BIM with facilities management is that the most important data on rooms, equipment types, systems, finishes, zones etc. do not need to be re-entered into the file. This avoids additional costs and produces high-quality data [11]. Facility management involves many regularly recurring activities, e.g. maintenance, servicing. In emergency situations, quick access to facility information (building geometry, fire zones, location of equipment etc.) is crucial, which is also possible from mobile devices [12].

Thus, the Autodesk Tandem platform is a comprehensive tool dedicated to those involved in the management of a building facility. It enables the model to be viewed without requiring equipment or specialised knowledge, automates the creation of lists and inventory statements, guarantees no risk of data loss and, above all, ensures efficient administration of the building facility. Management using the BIM methodology aims to reduce the effects of any type of emergency that a facility may be subjected to during its use phase.

At present, Polish managers' awareness of the use of BIM methodology is at a low level. Hence the need to disseminate modern solutions and the benefits of using them. The case study presented here can provide inspiration and serve as a source of basic information.

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Zarządzanie obiektem budowlanym z wykorzystaniem Autodesk Tandem

STRESZCZENIE:
Przedstawiono możliwości wykorzystania platformy Autodesk Tandem podczas procesu zarządzania obiektem budowlanym. Na najdojrzalszym etapie życia obiektu budowlanego, czyli eksploatacji, BIM staje się metodyką, która może przynieść konkretne korzyści osobom lub organizacjom zarządzającym obiektami. Obecnie w Polsce BIM jest na wczesnym etapie wdrożenia. Zarządcy obiektów budowlanych często nie są świadomi zalet stosowania BIM. Posiadając model 3D nasycony informacjami, możliwe jest efektywne zarządzanie, w tym planowanie remontów, konserwacji czy przeprowadzanie przeglądów. W artykule zestawiono zalety i korzyści wykorzystania BIM z perspektywy zarządcy obiektu, w tym przypadku budynku mieszkalnego, jednorodzinnego, wolnostojącego, w którym zastosowano specyficzne rozwiązania energooszczędne, wymagające bieżącego zarządzania i okresowej kontroli.

SŁOWA KLUCZOWE:
metodyka BIM; Autodesk Tandem; cyfrowy bliźniak; zarządzanie obiektami