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Strategies to Support Facility Management Resourcing Building Information Modelling

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1 Introduction

The building natural aging, associated with the lack of planned maintenance actions and the climate changes consequences contributed to accelerating the degradation of building materials in the existing buildings, leading to a poor conservation of Portuguese public building stock. Thus, to extend the service life of buildings and its the materials, the application of appropriate maintenance actions is imperative (Rodrigues, *et al.,* 2019). A consistent building performance evaluation supported by the BIM methodology, contributes to implementing an efficient and sustainable maintenance strategy, which is crucial to slow down the degradation processes and consequently to increase the materials service life (Marmo *et al.,* 2019).

2 Main Goals

The main objective of this work is to assess the building performance by the integration of Key Performance Indicators (KPIs), resourcing a BIM software - the Autodesk Revit, to prioritize the maintenance actions in a practical and automated way.

3 Methodology

For this purpose, the present work pursued a methodology with the following steps: i) Building information collection; ii) Building Life Cycle Cost estimation; iii) Automated calculation of Building Performance Indicator (BPI) supported by BIM, using Revit and Dynamo. In the first phase of the research, the information related to the building was collected and a building inspection was accomplished, in which the building materials and their anomalies were recorded. In the second step, the economic contribution of each building system (Wn) was calculated. In the third and last step, the integration of the BPI developed by Shohet(a) *et al.*, (2003); Shohet(c), (2003), into the Revit model through shared parameters and using Dynamo

programming to extract them as a final value to Microsoft excel was done. This methodology was applied to the case study of the Civil Engineering Department of the Aveiro's University, to support facility management (FM).

3 Main Results

The BPI results allows to assess the actual building condition. Analysing Pn value it is possible to conclude about which systems are requiring maintenance actions. Afterwards, to simplify the process, the values obtained in Figure 1 were categorized by colours, employing a BIM plug-in and it was obtained a visual maintenance prioritising as presented in Figure2.

Element	Cn	Fn	PMn	W(Cn)	W(Fn)	W(PMn)	Pn	Wn	BPI
Windows	73.78	79.49	21.54	37.50	37.50	25.00	62.86	7.86	4.94
Roofs	40.00	60.00	40.00	37.50	37.50	25.00	47.50	8.96	4.26
Structural Framing	78.39	100.00	20.00	45.00	45.00	10.00	82.28	9.85	8.10
Structural Columns	78.72	98.72	20.00	45.00	45.00	10.00	81.85	9.85	8.06
Walls Exterior	80.00	80.00	20.00	37.50	37.50	25.00	65.00	7.86	5.11
Walls Interior	80.00	80.00	20.00	35.00	35.00	30.00	62.00	17.49	10.84
Mechanical Equipment	20.00	20.00	20.00	20.00	20.00	50.00	18.00	2.45	0.44
Doors	79.62	80.00	40.19	35.00	35.00	30.00	67.92	17.49	11.88
Drainage system	80.00	80.00	50.00	37.50	37.50	25.00	72.50	3.18	2.31
Electric system	100.00	90.00	50.00	25.00	25.00	50.00	72.50	5.25	3.80
Elevators	100.00	100.00	80.00	30.00	30.00	40.00	92.00	8.28	7.62
Security (Fire, CTV)	100.00	100.00	60.00	37.50	37.50	25.00	90.00	1.49	1.34
							Total	100.0	68.70

Figure 1. Excel file with parameters and categories exported from Revit software by Dynamo software and BPI calculation.

Figure 2. "Color splasher" application to northeast façade.

4 Conclusions

This maintenance management strategy, which takes advantage of the interoperability of the Revit-Dynamo and excel allows showing the importance of BIM in FM. This methodology allows the permanent update of information in the model, having high potential to prioritise the building maintenance actions, extending the materials and building durability.

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