

Using the BIM 5D Tool for Public Works in Brazil

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Abstract: This article was developed with the purpose of analyzing the applicability of the BIM 5D tool for the elaboration of budgets of public works in Brazil. In order to do so, the government's initiatives in this regard were presented, as well as the functionalities of this tool that imply the facilities and gains for the public service in the elaboration of the budget of its works.

Key words: budgets, public constructions, BIM 5D

1. Introduction

Countries such as Finland, Denmark, Singapore, Norway, South Korea and the United Kingdom have made mandatory use of BIM in public works. The adoption of such a policy is motivated by the following benefits of BIM technology: improved coordination, reduction of errors and omissions as well as communication of projects, increase of productivity and efficiency of the construction industry, reduction of costs and deadlines [1].

In Brazil there are no government standards for the use of BIM, however, his employment in construction companies is growing at higher rates than in the others major global economies [1]. The use of this technology in public works, however, is still incipient, although they lack the benefits of BIM and are commonly objects of irregularities, as demonstrated by audits carried out by the Court of Auditors (TCU) in 2014 [2]. Therefore, improvements in the management of public works are needed to combat such irregularities.

With regard to use in the federal public administration, we have examples of the Brazilian Army and d Petrobras who have used BIM on some of its projects. Besides this, the Bank of Brazil has,

throughout 2013 and 2014, several project bids in BIM within the Regional Aviation Program.

In relation to standards and guidelines for BIM, the government of the State of Santa Catarina published guidelines on "BIM Project Presentation Pad". "In it are defined the standardization and formatting that should guide the development of BIM projects in contracting with the State Government" [3].

2. Goals

The main objective of this study is to make a bibliographic analysis and from Brazilian government agencies initiatives in relation to the adoption of BIM and its benefits. It also aims to make an analysis of the applicability of the use of BIM, with special emphasis on the 5D tool, for budgeting public works in Brazil and to verify as it can contribute to greater assertiveness of budgets.

The benefits of using BIM technology in the area of project design and execution are widely disseminated in both academic and professional settings, which has led to the publication of various standards and manuals in the area by several countries and even its adoption as mandatory in Some of them. However, in relation to the use of this tool for budgeting works public, there is a gap as the studies demonstrate the benefits of BIM. The objective of this article is to fill this gap,

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demonstrating how the use of BIM 5D can improve the assertiveness of budgets of Brazilian public works.

3. Justification

The justification of the theme for this work is that the study of BIM 5D is relevant in view of the large number of irregularities identified in public works.

The s Budget Guidelines Law (LDO) incumbent since 1998 the Court of Audit (TCU) to inspect the major works displayed them in order to identify the occurrence of serious irregularities. The TCU sends to the National Congress, annually, a list of enterprises in which indications of serious irregularities have been

identified, especially those that lead to a recommendation to stop. Based on these reports, the National Congress decides on the blocking or release of the resources necessary for the execution of these enterprises. The analysis of those reports allows to evaluate the irregularities that occur in most public works.

Analysing Table 1, it is verified that the occurrences of overprice/overbilling in the works correspond to 15.8% of the irregularities detected in public works and occur in approximately 38% of the audits for the period under study, demonstrating their impact on the works.

Table 1 Summary of TCU audit findings in the period.

	Audit Finding	Number of findings			Audits	
		Quant.	%	% accu.	Quant.	%
1	Over-price/Supercharge	415	15.8	15.8	253	38
2	Poor/outdated basic/executive design	341	13	28.9	255	38
3	Poor supervision or lack of supervision	291	11.1	40	77	12
4	Existence of unjustifiable delays in works and services	195	7.4	47.4	48	7
5	Execution of low quality's services	131	5	52.4	42	6
6	Restrictions on competitive bidding	115	4.4	56.8	95	14
7	Failure to comply with legal and technical accessibility requirements for persons with disabilities or reduced mobility	88	3.4	60.2	17	3
8	Bidding Budget/Contract/Incomplete or Inadequate Additive	69	2.6	62.8	63	9
9	Other findings with percentage less than 2%	974	37.2	100		
Total		2619			668	

Source: MATOS, CR DE and MIRANDA, C. DE O. Use of BIM in the fight against irregularities in public works.

According to TCU, overpricing is characterized “when the price of the work/service/input is unjustifiably higher than the price paradigm” and overbilling “when bill services of a work with overpricing or when bill services that have not been executed (whose quantitative measures are higher than those actually executed)” [2].

The OURT T Federal Audit points out the following factors as the cause of overpricing among others:

- By the measurement of quantities greater than those actually performed/supplied;
- By it breaches the initial economic-financial

balance of the contract in disadvantage of the Administration by altering the quantity (spreadsheet game) and/or prices (changes in financial clauses) during the execution of the work;

So, the main causes of overbilling are quantitative problems. In this aspect, the use of the BIM model allows the extraction of the quantities of the various materials in the model, due to the physical information inherent to the modelling elements [4].

Obtaining the direct quantification of the BIM model results in agility and accuracy of the values compared to the conventional method, which is subject to human

errors inherent to the process, which propagate throughout the cost analysis [5].

In addition, in the case of project change, the surveys from BIM technology are updated instantaneously, a fact that does not occur in the conventional method [5].

By connecting these elements to an external database containing the cost information, you can perform analyses. The estimate of the cost of construction will be the product of the quantities obtained in the model with the cost of a database, that connection between the model and the database will vary depending on the software, allowing the value of the work to be predicted and controlled [4].

The study of the use of the BIM 5D model is then justified in order to create mechanisms to improve the budgets of public works and to reduce the prices of the same ones. The use of BIM to extract the quantities of the design services allows agility and precision in the process, since most quantitative can be extracted automatically avoiding errors inherent to the manual process.

4. BIM for Public Works in Brazil

In Brazil, the Federal Government's initiative in this area is through the Brasil Maior plan, in which the following objective was established: intensify the use

of information technology applied to the construction and implementation of the construction information classification system — norm as BIM [2].

As a result of a cooperation agreement between the Ministry of Development, Industry and Foreign Trade (MDIC), Federation of São Paulo State Industries (FIESP), the Brazilian Agency for Industrial Development (ABDI) and Euclides da Cunha Foundation to Support University Federal Fluminense (FEC), in partnership with architectural offices, a library of most common components and materials, directed the program Minha Casa, Minha Vida (MCMV) was prepared [6].

The library for the MCMV program was developed in the REVIT software and made available as a template by the MDIC. This library is not endowed with innovative components but seeks to meet the main demographics of housing projects [7].

It is worth mentioning, however, that this library is very useful for modelling projects of other categories than just housing (commercial, educational, etc. ...), since many of the services executed are similar (Foundation, Structure, Masonry, coverage, etc. ...).

An interesting aspect to be remembered is that in the families developed for this template a field is available for insertion of the SINAPI code of said service.

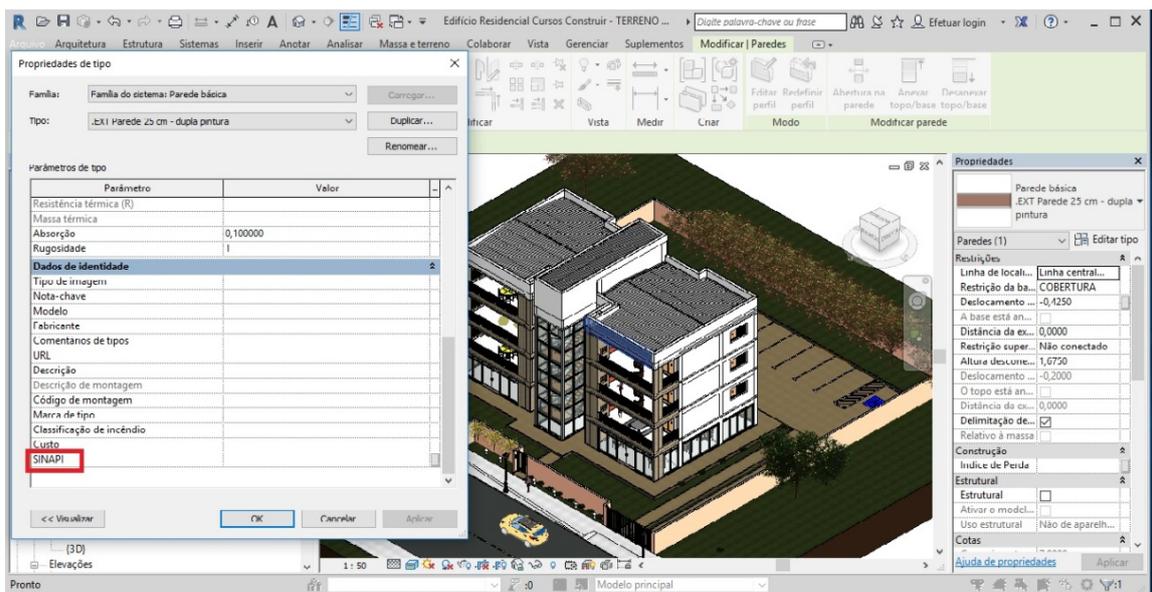


Fig. 1 Family example with SINAPI field template M CMV.

The public works budget with federal funds based on the SINAPI compositions has become a rule since Decree 7983/13 [8], as described:

“Art. 3. The overall reference cost of engineering works and services, except transport infrastructure services and works, shall be obtained from the composition of the unit costs provided for in the project that includes the bidding document, less than or equal to the median of its corresponding in the reference unit costs of the National System of Survey of Costs and Indices of the Civil Construction — Sinapi, excepting the items characterized as industrial assembly or that cannot be considered as civil construction.”

And therefore, in order to comply with this guideline of the public budget, the use of this template not only fulfills perfectly what can be recommended.

In addition to this template was also recently instituted a commission to implement BIM by the current president of the republic:

“Article 1 The Strategic Implementation Committee of the Building Information Modeling — CE-BIM, with a temporary character and with the purpose of proposing, within the Federal Government, the National Strategy of Dissemination of the Building Information Modeling — BIM” [9].

The use of BIM for the preparation of projects can make a lot more correct lifting of quantitative project services, since the lifting of quantitative by traditional 2D method is susceptible to many human errors and through the BIM 5D are made to many services automatically and with complete accuracy. So, the use of this technology can be very useful in reducing the discrepancies identified in the annual reports of TCU.

Amiri [10] researched the use of BIM for quantitative survey in a case study in the city of Vancouver. It is emphasized that BIM software presents surveys more efficiently and more precisely, as long as the models are created for such. That is, the greatest effort must be made in the creation of the besides presenting a considerable accuracy, compared to the conventional method. Thus, based on the

literature presented, it is possible to discern the great potential of the BIM technology in the survey of quantitative works.

5. Conclusion

Given the above facts, we can conclude that the use of the BIM model, in special the BIM 5D, can make public works budgets more assertive and, therefore, can strongly contribute to reducing the discrepancies that are annually noted of irregularities in public works by TCU.

Despite the benefits that the use of this technology can bring to the public service, in Brazil its use is still very timid making this subject of great relevance for scientific studies.

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