Evaluation of the additional public infrastructures during the execution of the construction

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Abstract: The objective of this research is to evaluate the Additional Services during the execution of Public Works; because a significant percentage of their contracts are affected, it was identified and analyzed so that the research proposes measures to be applied to improve the procedure in the preparation of technical files, to eliminate the most frequent errors found in the last five years. The results showed that the highest incidence for additional services was 14.22%, and the lowest was -10.46%. The evaluation concluded that one of the leading causes with the highest incidence in the approval of additional work services is the deficiencies in the technical files.

Keywords: Performance, evaluation, construction execution.

1. Introduction

In the public sector, where the Peruvian State is the owner of the works, it is noted that during the last five years, the works contracts have undergone modifications during their execution, including Additional Services, Larger Scope of Work, and Time Extensions.

The Additional Services of Minor Works or equal to fifteen percent (15%), is one of the most frequent types of contract modifications, caused by deficiencies in the technical file or unforeseeable situations after the Contract was signed or due to unforeseen causes in the technical file of the work and which are not the contractor's responsibility. [1]

Article 34 of the Government Procurement Law in force grants the Entity the power to approve the contract or the execution of Additional Work Services for up to fifteen percent (15%) of the total amount of the original Contract, provided that they are indispensable to achieve the purpose of the Contract. [2,3]

Within the framework of public works and their contracts, an analysis will be made of the so-called Additional Services, the administrative and control function immersed therein, the application or not of arbitration concerning the figure in question and the application or not of the principles of the prohibition of unjust enrichment without cause and the direction of equality before public burdens. [4]

As a consequence of the above described, the causes will be evaluated, and an improvement in the procedure and the stages of elaboration of the technical files of works will be proposed, grant a better quality in the information required for the execution in such a way that the approval of Additional Services will be eliminated.

2.Method

2.1.Study area

The following graph shows the study area where the works considered for this article are located: the department and province of Lima (See Figure N°01).

Fig. 1. Location of the study area

2.2.Procedure

For the present investigation, the bibliographic review has been considered: the TechnicalFiles' evaluation, the unforeseeable causes after the signing of the Contract, and the hidden defects. The Public Works contracts of the last five years in the department of Lima were taken as the unit of analysis. As for study techniques, the documentary review and the comparative technique will be used to determine the reasons for which the Additional Services to the Public Works Execution Contract have been originated. [5]

The collection of information (data) is the raw material, which consists of a meticulous process. It is possible to explore, describe and explain facts or phenomena that define the research problem. It should be noted that the sources are facts or documents that the researcher uses to obtain information. Techniques are the means used to collect information. [6]

As a result, the different causes and types of additional ones have been established, the information was prepared based on work experience throughout the 5 years

3.Data tables

Table 01. Types and Causes of Additional Work Benefits from 2015 to 2020

Item	Work	Year	Type of Additional Benefit	Causes
1	"Improvement Of Slopes And Access Roads In Areas At Risk For Landslides In	2015	Additional Benefit and Work Deductible N°01	Variation of drawings/technical specifications during contractual execution.
2	Risk Due To Landslides In AA.HH. La Cumbre Del Progreso	2015	Additional Benefit	Variation of drawings/technical specifications during contractual execution.
3	of the District of Carabayllo, Province of Lima - Lima".	2015	N°01 AND	Deficiencies In The Technical File
4	(SNIP N°264014)	2016	Binding Deductive No. 01	Deficiencies In The Technical File
5	Construction of Roads and Sidewalks in the Cooperativa de Vivienda 26 de mayo, District of Ate, Lima.	2017	Additional Work Deductive	Deficiencies In The Technical File

6	mayo, District of Ate, Lima - Lima. Contract N°020-2015-O/MDA	2018	N°02	Situaciones Imprevisibles, Posterior A La Suscripción , Del Contrato
7	Recovery and Reinforcement of Santa Rosa and San Martin Tunnels in the districts of Rimac	2018	Additional Work N°01 AND Binding Deductive N°01	Deficiencias En El Expediente Técnico
8	Districts of Rimac and San Juan de Lurigancho.	2019	Binding Deductive No. 01	Situations, Unforeseeable Subsequent To The Completion of the Contract
9	Construction of Roads and Sidewalks in the Internal Streets of Zone T of the AA.HH. Huaycán, District of Ate, Lima, from Contract N°041-2015-O/MDA.	2019	Additional Work Addendum N°28, Binding Deductive "Miscellaneous Works N° 02" of Contract N°018-2013-MINSA.	Deficiencies In The Technical File
10	Computer Equipment and Electromechanical Equipment	2020	Additional Budget	Deficiencies In The Technical File

In table 01 shows that during the last five years in the Department and Province of Lima, the most frequent cause of Additional Benefits is deficiencies in the Technical File of the work.

Table 2: Percentage of incidences due to Additional Works Services.

Item	**Work**	**Contractual Amount (S/.)**	**Amount of additional work (S/.) I.G.V**	**Incidence (%).**
1	"Improvement Of Slopes And Access Roads In Risk Areas Due To Landslides, Due To Landslide In AA.HH. La Cumbre Del Progreso, Of The District of Carabayllo, Province of Lima - Lima." (SNIP N°264014)	819,813.95	74,029.20	9.03
2	Computer and Electromechanical Equipment for the Public Investment Project: "Strengthening of Emergency Services and Specialized Services - New Hospital of East Lima - Vitarte" - SNIP 57894.	157’394,047.16	2’151,876.62	1.37
3	Improvement of Las Begonias Street, district of San Isidro-Lima, with SNIP Code 372941	8'916,553.97	252,527.34 Additional 262,054.66 Deductive	0.98
4	"Renovation of access roads in the Municipality of San Isidro on Alferez Alfredo Salazar Street, district of San Isidro"	483,711.13	68,780.06	14.22
5	Construction and Equipment of the Cañete Hospital" - Meta II	118’263,414.17	117,277.24	0.01
6	Improvement of the vehicular and pedestrian trafficability of Victor Malásquez Avenue between Paul Poblet Lind Avenue and La Molina Avenue, District of Pachacamac, Province of Lima, Lima Region".	62’529,884.27	42,182.81	0.067
7	Construction of Roads and Sidewalks in the Cooperativa de Vivienda 26 de Mayo, District of Ate, Lima - Lima. Contract N°020-2015-O/MDA	2'657,190.79	375,195.34 Additional 652,887.66 Deductive	14.12 24.58
8	Recovery and Reinforcement of Santa Rosa and San Martin Tunnels in Rimac and San Juan de Lurigancho.	70’685,111.06	2’004,885.09	2.84
9	Construction of Roads and Sidewalks in the Internal Streets of Zone T of the AA.HH. Huaycán, District of Ate, Lima, of	2’447, 697.69	100,860.29 Additional	4.12 4.33

	Contract N°041-2015-O/MDA.		105,908.36 Deductive	
10	Improvement of the Irrigation System in the Cusirumi- Santo Tomás C.C. Cochamarca Sector, district of Cochamarca-Oyon - Lima- SNIP N°271919.	2'439,044.37	27,331.20 Additional 57,606.61 Deductive	1.12 2.36

Table 2 shows that the additional benefit with the highest incidence is in item 4, 14.22% of the contract amount.

4.Results

4.1.Graphics analysis

Table 1 and figure 2 have extracted the financial information regarding the incidence rates originated by the Additional Services approved by the Public Entities to the companies executing the works, respectively. [7,8], graphics 1 shows the incidence percentages of the Additional Work Benefits approved by the Public Entities during the period from 2015 to 2020; it can be noticed that these vary from < -10.46%, 14.22%.>.

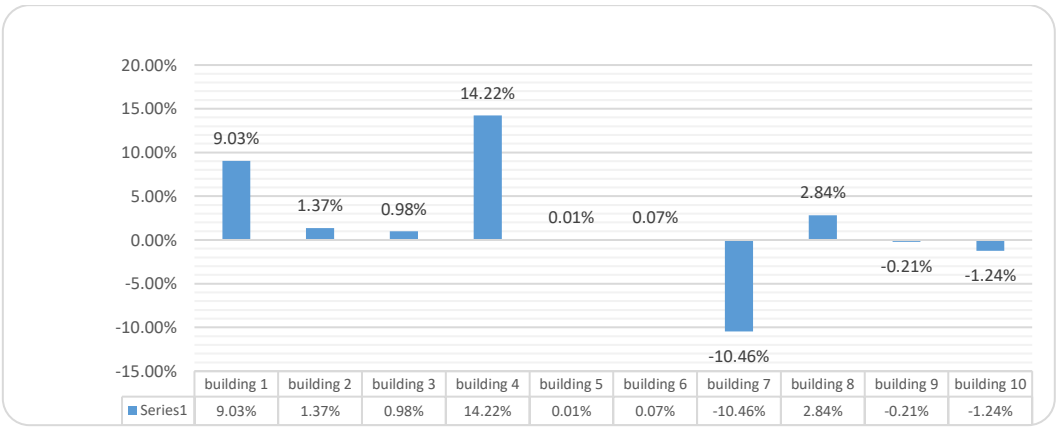

Figure 2.- Percentage of Incidence of Additional Work Benefits approved in Lima's last five years.

In figure 2, shown in the graphics, the highest incidence for fringe benefits was 14.22%, and the lowest was -10.46%.

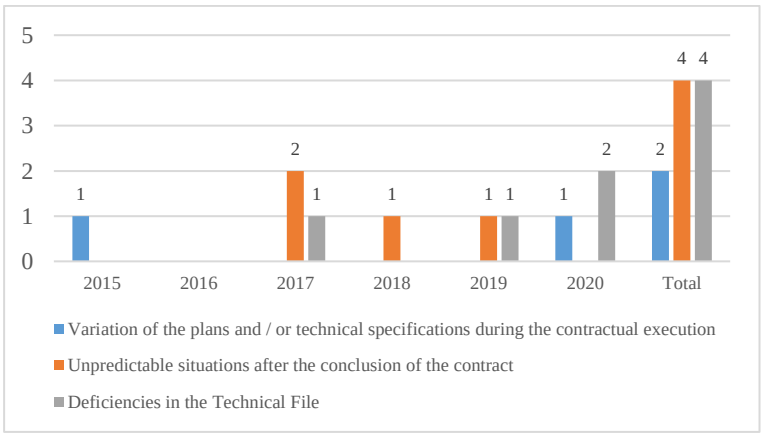

Figure 3.- Causes for Additional Work Benefits during the last five (05) years.

Figure 3 shows the causes that originated the Additional Services in the works evaluated in this article, showing that in 2017 the leading cause was Unforeseeable situations after the completion of the Contract and in 2020, it was Deficiencies in the technical file of the work. [9]

4.2.Outcome Evaluation.

From the analysis of the Additional Works Provisions approved by the State Entities, it was identified that the most frequent cause is "*unforeseeable events or force majeure*" and "*deficiencies in the technical file*." [10] Causes for Additional Work Benefits during the last five (05) yearsIn this regard, "*Fortuitous event or force majeure is previously defined as a non-imputable cause, consisting of an extraordinary, unforeseeable and irresistible event, which prevents the execution of the obligation or determines its partial, late or defective compliance*." [11,12]

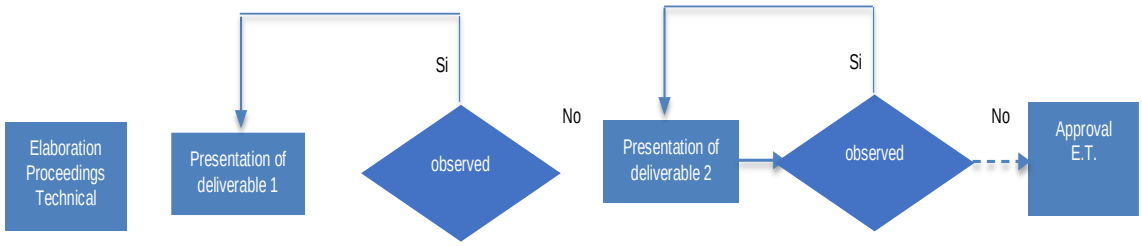

Figure 4.- Elaboration Proceeding Technical

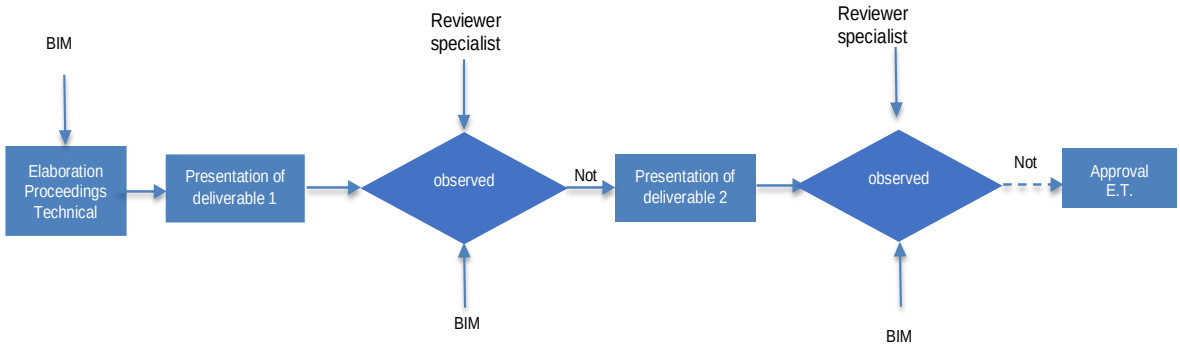

Figure 4, can see the sequence of the technical file elaboration when it is approved and rejected.

Figure 5.- Elaboration Proceeding Technical BIM

Therefore, it is necessary to exercise better control in the formulation, preparation, and approval stages of the technical files, i.e., from the pre-investment stage, using formats and documents with standardized criteria that comply with established technical standards. [13,14]

Likewise, it would be favorable to prepare a model or protocol for reviewing the technical file, where the technical aspects of the regulations, design criteria, metrics, construction budget, technical specifications, execution schedule, plans, project compatibility, and environmental elements are verified, using the tools provided by the BIM system. [15]

Finally, it is considered appropriate to hire a specialist with extensive experience and knowledge of the BIM system to prepare technical files to review and evaluate the different stages of preparation of the technical document. [16,17]

5.Conclusiones

The highest incidence for additional services was 14.22%, and the lowest was -10.46%.

From the evaluation carried out, it is concluded that one of the leading causes with the highest incidence in the approval of Additional Work Provision is the deficiencies in the technical files.

It is necessary to rethink preparing the technical files; for this purpose, the BIM system should be used.The hiring of a consultant specializing in preparing technical files with knowledge of the BIM system to review and evaluate the progress and deliverables submitted by the designer or consultant in charge of preparing the project

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