

**IMPLEMENTATION OF AN ONLINE FORMAT FOR MONITORING AND
CONTROL OF MULTI-PROJECT ACTIVITIES FOR THE COMPANY GYR
CONSTRUCCIONES SAS.**

FINAL REPORT

MODALITY: PASANTIA

COMPANY: GYR CONSTRUCCIONES SAS

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1. ABSTRACT

The degree work has focused on achieving the correct constructive practices of monitoring and control of daily, weekly and monthly activities carried out by the company for its different contracts and works throughout Cundinamarca and Colombia. This is done through an online weekly verification format that is consistent with each contract, city and budgeted amounts. It also consisted of the opportunity for the practitioner to develop communication and decision-making tasks with the parties to the contract, namely: Audit and the contracting company. The format and proposals established by the practitioner focused on the same principles as a construction management software package. Free online resources were used to carry out the practitioner's proposal, working on a free version of enerve and Excel Microsoft online. The actions developed were able to increase the efficiency in the report of works to the work management and management of the company and in turn this developed better processes for preparing partial delivery certificates as well as their corresponding payments.

1.1 keywords: CIMS, Construction management, web-based technologies.

2. INTRODUCTION

The company GyR CONSTRUCCIONES SAS is an institution dedicated to private and public sector construction activities, which is characterized by more than 10 years of experience in urban planning, hydraulic networks and public space construction activities. It is currently recognized as an important company in the private sector for executing its works and contracts accurately and efficiently, as well as for providing dedicated support to its clients in the beginning, development, delivery and liquidation of the works. It has been characterized by developing simultaneous activities in different works and cities of Cundinamarca and Colombia, which demonstrates its economic and administrative strength.

The proposal of work of degree seeks to favor the processes of the company GYR CONSTRUCCIONES S.A.S. However, the quality offered by a company in any of its processes also benefits customers. In this case, being able to have clear information about the activities carried out in the field allows those who direct the projects to make modifications and adjustments in an immediate way, which provides security and confidence in the clients and workers. In addition, the contracting company finds credibility and trust in GYR CONSTRUCCIONES S.A.S. In the execution of civil works of urbanism of the company GYR CONSTRUCCIONES SAS a very important variable is presented at the time of giving optimal results; the planning and execution of activities as well as their corresponding submission to the supervisor and the contracting company.

For years this same aspect of the works has marked the difference between some projects and others. According to (ICONTEC, 2015) in order to keep the order of processes, documentation must be maintained to support operations and guarantee the quality of the work performed. Failure to carry adequate documentation to support the work carried out such as calculation

reports, partial court work, support of technical trials, delivery formats and receipt of supervision results in a deterioration in the contracting, contractor and supervisory relationship as well as misinformation between one and another.

The Ministry of National Education (Ministerio de educación nacional, 2008) through the supervision and supervision manual establishes that a monthly report should be kept describing the execution of the project and a project control format in where the activities are quantified and described. However, this requirement is usually carried out with less accuracy than expected, due to the number of activities that are carried out daily in an urban planning project, which causes problems in the partial cuts of work and liberation of activities specified by the contractor and its economic delays in the execution of the contract. In addition to the delays, this does not allow to visualize the program of work since it does not take a daily control with accuracy or adequacy of so many different activities. Therefore, a method is necessary for the supervision of different contracts and their progress in which a daily work control is kept and which is known to the contractor.

The internship proposal is considered important when contributing to GYR CONSTRUCCIONES S.A.S an improvement action to provide quality and speed to its projects, facilitating the execution of works and a report in its current state.

When offering and providing knowledge in the development of work activities regardless of their area of application, this allows growth in the two parties, who contributes (the intern) and the company GYR CONSTRUCCIONES S.A.S. The acquisition of work experience based on daily practice allows the student to build knowledge and develop business skills for future applications based on their work in future jobs and projects.

Although the proposal seems quite simple, it means a lot when it comes to establishing partial work cuts and continuing contracts correctly since it establishes a basic connection between the work residents, the construction management and the management of the company.

This also established best practices on the part of the contractor in order to deliver the activities to the supervisory and supervisory entities, which contributes significantly to the correct construction practices and solidifies the administrative part.

3. OBJETIVES

3.1. General objective

Perform the student practice at the company GYR CONSTRUCCIONES SAS, performing work related to civil engineering and thus obtaining the experience as an internship of the UNIVERSIDAD ANTONIO NARIÑO.

3.2. Specific objectives

- To implement an online information format to monitor activities in multiple projects for the company GYR CONSTRUCCIONES S.A.S located in the city of Bogotá D.C and Cundinamarca.
- To be a valuable resource for the company by working closely with the audit and the contracting party, which allows developing better and more constructive processes.

4. CONCEPTUAL FRAMEWORK

The company GYR CONSTRUCCIONES S.A.S is dedicated to the development of civil works construction activities mainly of urban planning and public space, as well as road and transport infrastructure, and supply of stone quarry materials. It is characterized by implementing and executing excellent construction practices with optimal handling conditions and durability. He has developed works around the entire department of Cundinamarca and Bogotá DC, thus serving as a maker of works of great value and importance for the region and for different construction companies.



Image 1. Job history. Source: (GYR CONSTRUCCIONES SAS, 2019)

The company GYR CONSTRUCCIONES S.A.S has developed works in many parts of Colombia and has established excellent relationships with solid private sector companies. Some of them are:

Contratante	Descrip. Obra	F. Inicio	F. Term
SURESCO LTDA	OBRA CIVIL	2012	2013
SOLUCIONES INGENIERILES S.A.S	SUMINISTRO Y TRANSPORTE DE MATERIALES	2013	2016
MAQUI-AMARILLAS S.A.S	OBRA CIVIL-SUMINISTRO Y TRANSPORTE DE MATERIALES	2014	2017
CONMIL S.A.S	OBRA CIVIL	2015	2017
PRODES I CIA LTD	OBRA CIVIL	2015	2019
APIROS	OBRA CIVIL	2017	2018
MARVAL S.A	OBRA CIVIL	2018	2019

Image 2. Most representative costumers. Source: (GYR CONSTRUCCIONES SAS, 2019)

In the construction processes, we find variables that determine the success and good execution of the contracts. As they are the type of project, the activity that is going to be carried out (studies and designs, supervision, management, etc. ...), size of the company and value of the contract. With these clear variables it is necessary to establish a balance between the contracting entity, and the contracted party, "Being the Audit Department a figure that acts as a harmonizing entity between the contracting entity and the contractor; where its position must be neutral vis-à-vis

both parties, and its general objective is to guarantee that everything agreed in the specifications and the contract is complied with (Urdaneta, 1998).

The concept of centralized information in construction, since it usually denotes the need to store the information of several types of projects in a single database and not only several types of projects but also a considerable amount of disciplines to execute a single project, so when the information manages to focus on a single conceptual framework this contributes to the real growth of the construction companies.

In this case that the practitioner has raised an obvious need to improve the processes of GyR CONSTRUUCIONES SAS with respect to their own relationships between workers and management, then it is necessary to remember that information management should be evaluated in all companies. For example, it is found that the information is extremely dynamic in every way since it changes from day to day and from one project to another, even if we talk about the same kind of information, it will be different then if we evaluate it in another place, circumstance or contract That is why there are cycles from the beginning of the work that must be met, such as the creation, storage, handling, transmission, reformatting, application and review of the information. According to (Ali & Al-Kodmany, 2012). The consequences of using inappropriate or inaccurate data can be costly and result in unnecessary delay. The efficiency of the construction development and operation cycle depends on the integrity and effectiveness of the information flowing between the client, design engineering, equipment manufacturing, contracting, and facilities management segments of the construction industry. As the technological tools of the information are used, the relations between the entities will improve and increase, so that the possibilities of keeping everything in a focused and integral database are always studied.

Just as good results are found when properly using the information, it is important to highlight that any changes or modifications to the information would already make it outdated, so when working on editable online systems it is guaranteed that any change will be recorded and delivered to all users immediately. Centralized information has been endorsed and recommended by several entities such as (Construction Industry Development Agency in Australia (Chan & Leung, 2004) and the Construction Industry Institute in USA (The Construction Industry, 1996) the advent of high-level computer systems now makes them a viable option.

Now the industry since the mid-1990s has been able to sell the internet as a great vehicle to integrate and disseminate information around a network of participating groups and organizations, which has been the strong conviction of many companies that have used this means to create your databases. In addition, these types of systems have become increasingly indispensable and easily accessible for today's businesses. For example, if someone wanted to communicate, make a payment or request supplies, they could do so either online or by phone, however, the second prevails with several advantages over the second, so it is said that the internet has come to change the intrinsic value of things and products and has come to reform the how of construction and its exchanges of internal and external information.

The internet has been the most changing discovery in the last century, and has caused a great reduction of processes and requirements in practically all labor fields. It has become a cost-effective, universally accepted and readily available delivery system. The Web offers unparalleled communication opportunities for the construction industry, particularly its facility to accommodate a wide range of media types (text, voice, objects, etc.). It is now possible for construction firms to build up local and/or global information networks with low access cost

using affordable hardware and software. The access control and security measures available on the Internet can ensure data protection and integrity.

The Internet has moved the world to a new phase of unprecedented changes and technological advances, it has filled the world of communication, television and radio with great advantages and few disadvantages; the construction sector is no exception. The adoption of technology in the world of construction and the most important firms has been leaps and bounds. Image 3 shows the barriers that prevent the acceptance and usability of web-based technologies, as well as the great advantages and paths that lead to their imminent acceptance already taken in the construction market.

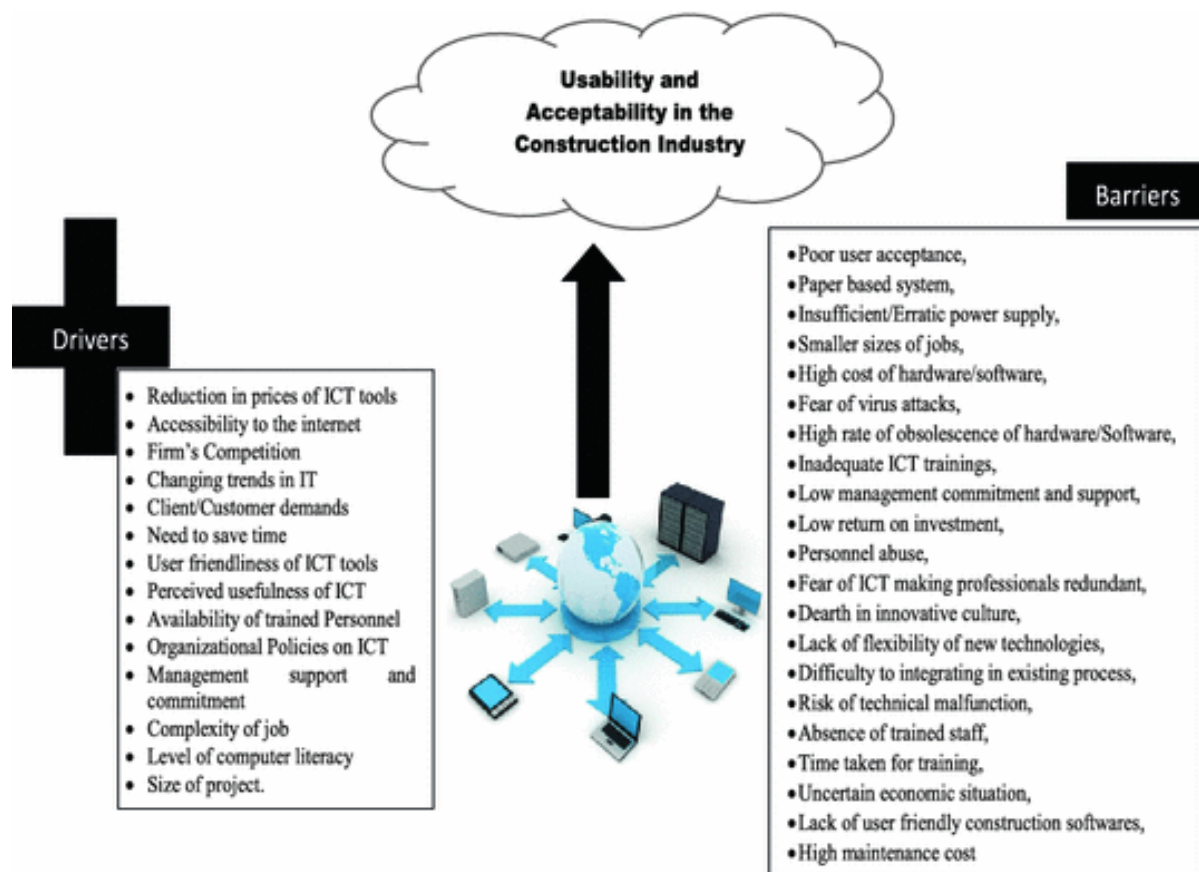


Image 3. Drivers and barriers to web-based technologies in the construction industry. Source: (Marques, Sousa-pinto, & Silva-costa, 2017)

The development of a successful web application (website) involves many different types of design, including functional design, software architecture, business process or workflow design, user interface design and database design. The purpose of the web-based material planning and control model is to have an interactive web-based interface that allows construction professionals to estimate and specify amounts of construction material, while planning and controlling use of building materials by time. The database systems used on the web are currently used in most construction companies. However, only some of them are quite popular and widespread thanks to their applicability. (Chan & Leung, 2004) presents three types of web-based applications, a saber; the fee-based project management service, own construction solutions and software enabled for the construction industry.(Sarmiento, Sosa, Sanchez, & Angarita, 2018)

A builder or project manager of the construction site and end users can access the platform through a login page. The Director, the central office or any other official allowed through the persons and the permit can access critical information on the state of the construction materials that will be used and on site, which leads to transparency, openness and accountability. In addition, there is a messaging platform where end users can use to make and send clarifications to the project manager about what was noticed about the current project. The messaging platform also stores the previous messages that have been sent to the project manager about deficiencies in construction materials on the site. (Marques et al., 2017)

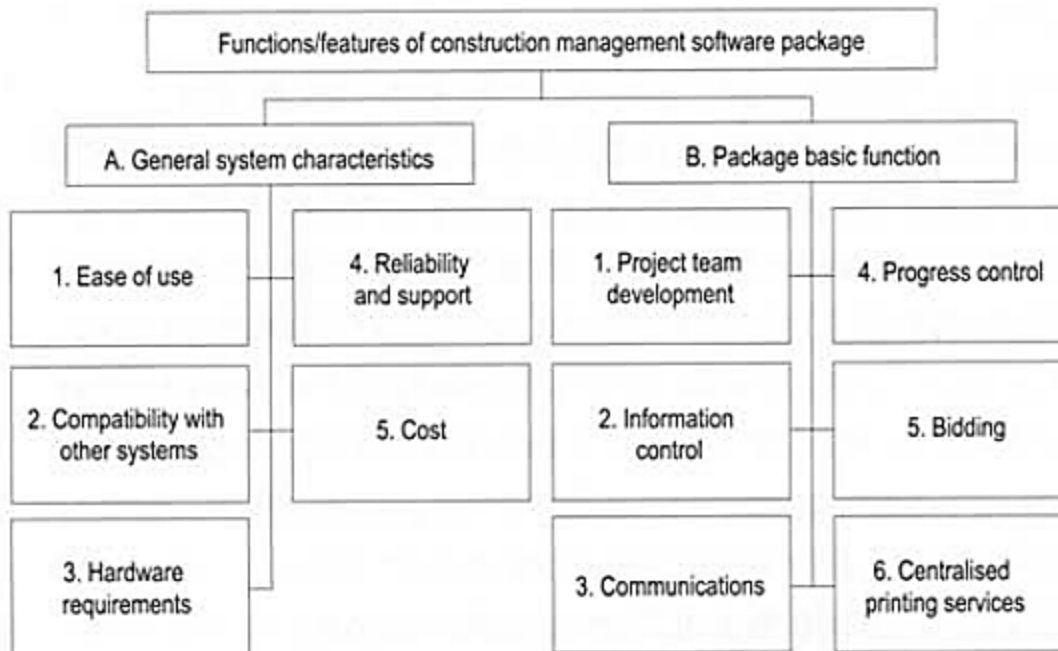


Image 4. Hierarchy of features and functions in web-site CIMS selection. Source: (Scott, Cheong, & Li, 2012)

4.1. Web-based construction information management systems

Web-based construction information management systems. You can use browsers, data management devices and other Internet technologies to create a network to share and manipulate corporate information in a way that helps construction project managers to complete work on time and on budget. These have a certain hierarchy with which they are designed for this reason it is important to analyze them since according to (Scott, Cheong, & Li, 2012) there are two main functions in the hierarchy mentioned:

4.1.1. General System Characteristics

4.1.1.1. Ease of use.

With the conclusion that, as complex as CIMS is, a simple and descriptive format should be maintained for all types of people, since its effectiveness will be measured primarily by the time it takes the user to interpret the tool and get to use it with performance.

4.1.1.2. Compatibility with other systems.

Must be able to work with total confidence in collaboration with other systems, and be fully compatible so that its use is not discarded for minor reasons.

4.1.1.3. Hardware requirements.

In general, the functions that manage construction information are robust due to the amount of data and the frequency with which they are updated, so it is important that you can work with the most reliable and accessible operating systems of the market so do not discard its use due to incompatibility or poor physical memory. In addition to the operating systems, the need that can be incorporated in “Smartphone” mobile devices working on Microsoft or Google, especially for the specific case of GYR CONSTRUCCIONES SAS, is evident.

4.1.1.4. Reliability and support.

It is understood that the reliability of the product comes from the supplier or source, so problems should not occur with a system that is being beneficial to the company, however, it is vital that the support and possible future modifications You need the system to be guaranteed by the manufacturer, as well as a user manual and training of personnel for the proper use of CIMS.

4.1.1.5. *Cost.*

Last but not least, what customers put into consideration when making decisions; the direct cost, although in this case the company GyR CONSTRUCCIONES SAS would end up being benefited by the practitioner and the ANTONIO NARIÑO UNIVERSITY as this is a newly agreed labor practice.

Without leaving behind the construction information management system, the package functions offered are now evaluated as these should be focused on improving the administrative management of the company GyR CONSTRUCCIONES SAS. Which are described by (Scott et al., 2012).

4.1.2. Package basic function

4.1.2.1. *Development of the project team.* The most important of its functions is what should be a support to the work team, as well as management, turning common opportunities into important moments to improve and bring greater profits. All this is starting in that the human resource is the most important of a company.

4.1.2.2. *Information control.* The characteristic for which we are discussing this issue is specifically the handling of specific data, as well as its organization and quick report. So the CIMS must be characterized by the control of the corresponding information.(Ozorhon, Karatas, & Demirkesen, 2014)

4.1.2.3. *Communications.* The administrative management of a company corresponds to the correct communication generated between the parties, so this tool is guided to the parts of a company and create good internal administrative processes and with the contracting party.

4.1.2.4. *Progress Control.* Although minimal, there should be progress indicators that accelerate and accelerate processes, these are usually measured according to what the contract is going to be executed.

4.1.2.5. *Tender.* Corresponds to the manner in which it receives offers and handles the assignment of tasks to subcontractors and how it makes the exchange of information necessary for management.

4.1.2.6. *Centralized printing services.* The reprographic module requires remote printing with delivery services by the printing company for the printed copy of drawings and documents.

4.2. Microsoft Excel

Among the resources to be used in this practice are Microsoft Excel which is characterized by being a version of the spreadsheet that has been adapted to work from an Internet browser as of February 2014. It is important to mention that the intention of the Excel version online has never been to replace the desktop version, but it is a complementary tool that helps us to open Excel workbooks just by having an Internet connection and without the need to have an Office version installed in the computer.(Moisés Ortiz, 2011)

However, it is important to mention that a spreadsheet is a type of document that allows manipulating numerical and alphanumeric data arranged in the form of tables composed of cells, which are usually organized in a two-dimensional array of rows and columns.

The cell is the basic unit of information in the spreadsheet, where the values and formulas that perform the calculations are inserted. It is usually possible to perform complex calculations with formulas and / or functions and draw different types of graphs.

The management - at least basic - of Excel has become an almost mandatory requirement of the Vital Curriculum of anyone who wishes to be hired for a conventional job; and more than an extra skill, knowing how Excel works is a necessity.

It is probably the most important software in any workplace that uses computers and is one of the most used programs by companies, companies and small businesses, especially in the accounting area.

Its functions as a spreadsheet allow many facilities to keep track of financial activities, as well as its options to organize information both numerical and alphabetical data for subsequent presentation in reports, balance sheets, tables and graphs.

Both for office work, as for small and medium-sized entrepreneurs, school or academic work, or simply for casual use, the functionality of Microsoft Excel is reported worldwide as the easiest and most efficient to use (Moisés Ortiz, 2011)

4.2.1. Cells. It is a two-dimensional matrix of intersecting columns and rows that forms the famous and well-known grid of the Excel presentation. The information is entered in the cells, which is the small rectangle where each row and column meet.

4.2.2. Worksheet. The worksheets are identified in the lower left with labels that can be renamed to the user's needs.

4.2.3. Workbooks. It is the common name of Excel files which can contain several worksheets. To switch between worksheets, simply select the labels located below and to the left of the program screen. Traditionally, workbooks were stored in files with the extension '.XLS', but since the 2007 version the extension changed to '.XLSX'.

4.2.4. Ribbons of options. From the 2007 version, the programs of the Microsoft Office package replaced the traditional menu with ribbons with the options arranged in icons. They

are a kind of visual menu where options remain open. Each tape contains a series of functions related to characteristic icons. For example, the "Start" ribbon has the most common options such as type, color and font size; The "Insert" tape contains the functions of inserting tables, pictures, and images, among others.

4.2.5. Formulas. In addition to numbers and text, cells can contain formulas and this is the peculiarity that makes Excel a spreadsheet par excellence. With the formulas, Excel presents the result of a mathematical operation in the selected cell. For example: when writing “= 3 + 5” in a cell, the program will show the number “8”.

4.2.6. Functions. Excel offers a series of more complex and specialized default functions that could be added to formulas, such as mathematical and trigonometric operations such as subtraction, sine and cosine; financial as discounts and rates; and other statistical, referential and logical functions. In each cell there can be only one formula, but each formula can contain multiple functions.

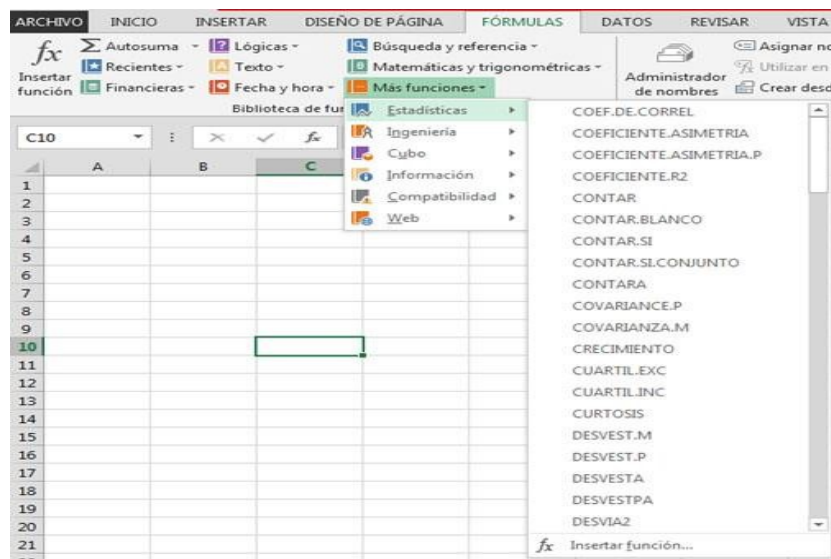


Image 5. Excel Functions. Souce: Own development

4.2.7. Graphs. Excel allows you to visually present the data of a worksheet with different types of graphs. Depending on the purpose, the program offers bar, pie or pie charts, line, area and XY scatter charts.

4.2.8. Excel tables. It is a tool for structural storage of tabular data in a selection of columns and rows that the program maintains independent of the worksheet, for the subsequent handling by the user.

4.2.9. Pivot tables. Also called pivot tables, allows the analysis of large amounts of data within the worksheets and then present them in complex reports or tables without writing formulas.

4.2.10. Macros. These are small programs that are written in the programming language of Visual Basic or "VBA" (Visual Basic for Applications) that help the automation of processes and operations in the worksheets. It is a feature for advanced users that allows programming connectivity in databases, analytics, forms, algorithms, filters, web searches, among others.

4.3. Audit

Auditing from a legal point of view is known as the action by which the control or the execution of a project is delegated to a natural or juridical person (Sanchez, 2010) However, it goes much further than this as it focuses on the details and short and concise actions, that is to say, if a supervisor has the task of supervising a specific work, he or she must know the constructive process of each activity that leads to the final result and follows it until it has concluded in the most optimal way. This means that the supervisory service must be a planned, systematic, timely and documented execution. Being an organized and documented process, this part uses technical support in files and folders that have been carried out with order and responsibility during the

execution of the work.(Marques et al., 2017)

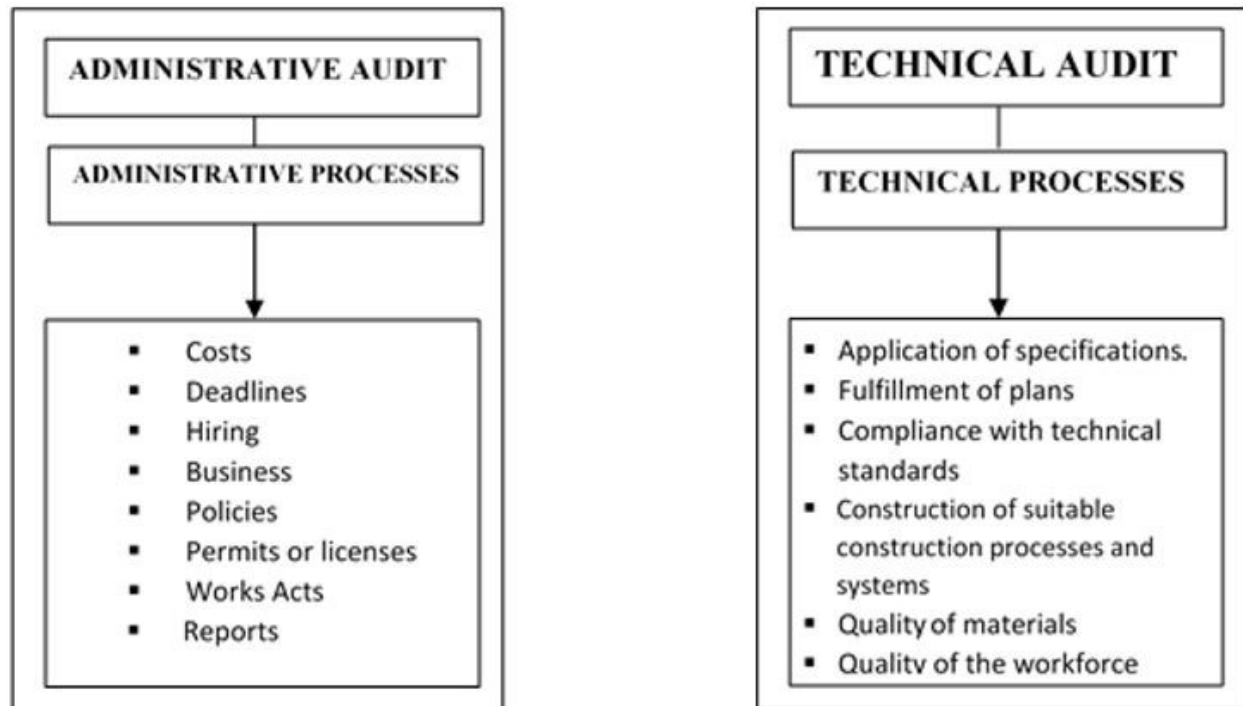


Image 6. Technical and administrative processes of the auditing. Source: author's design.

4.3.1. Audit principal Functions

In this way we can mention some functions and duties of the auditing and as such of the contractor, against State contracts, thus:

Ensure compliance with contractual obligations by achieving the development of the objects of the contracts within the time and investment budgets originally planned. (Sánchez Henao, 2010)

- Verify that the requirements for improvement and legalization have been met in full before the execution of the contract has been completed.
- Subscribe the act of initiation of contracts, to formalize the start of work.

- Monitor compliance with contractual terms, the validity of the contract and the protection of the single guarantee.
- Follow up on the fulfillment of the obligations of the contractor, to sign the record of compliance with the obligations.
- Present in writing to the contractor the observations or recommendations that it deems appropriate for the best fulfillment of the service.
- Supervise the execution of the resources delivered by the entity to the contractor for the development of the contract.
- Promptly notify the corresponding areas, about any delay, partial or total breach of obligations during the execution of the contract, so that the appropriate measures are adopted.
- Prepare the final settlement project upon the termination of the contract within the established deadlines.

Every professional who performs his work as a contractor, auditor or technical manager, must fulfill with pride, in truth the mission that has been assigned to him; for the benefit of a people, community or individual. This will guarantee the quality of processes that the contractor executes. In general, it is necessary to have an excellent list of processes and activities between the contractor-contractor and the supervisor. Since this generates confidence and affinity in the execution of the contract, which improves and accelerates the constructive processes of whatever the activities are.(Ministerio de educación nacional, 2008)

Another important aspect that has been discussed in different parts of the world concerning this topic is professional capacitation. Especially when we talk about civil engineers in charge of the technical and administrative supervision of the projects.

The supervisor and the contractor are in the habit of keeping information that certifies and validates the activities that are done during the execution of the contract, these are quality processes of the contractor's policies, and this information is related in reports and is within the most important functions of the auditing.

Student entities such as the Catholic University of Colombia and international institutions have made progress in the study of administrative processes and the execution of contracts in Cundinamarca.

During the monitoring and control process carried out by the Infrastructure Secretariat for public works contracts, it is necessary to take into account the characteristics of the construction process, which are governed by the parameters of the regulations in force in the national territory. The contractor and supervisor within the contractual obligations must periodically present the budget of the work accompanied by graphic memories, supporting the item and chapter in execution. However, within these deliverables, both contractors and supervisors deploy this information in different procedures, so that supervision and control entities have difficulty reading and interpreting them, which in turn generates longer review and verification times of quantities, which can cause 13 errors of reading in contractual items that prevent speeding up the payment process by the contracting party.

According to the foregoing, it is necessary to design a unique procedure that allows to capture the necessary information both graphic of the project and budget and identify the status of the contract in the periods established by the Municipal Mayor's Office, through the Infrastructure Secretariat, in the road construction projects, unifying the reading of these documents, where you could obtain the percentage of progress of work of each activity, estimated time of completion and value of the contract, managing to speed up the review times, improving the delivery times,

relationship of payments, optimization of administrative and technical staff, taking into account that by designing and feeding the bases of the procedures in an accurate and responsible manner, it will allow us to advance in administrative and financial processes. However, it will be necessary to train the professional staff of the contractor and supervisor, which will reduce operating costs (Sarmiento, Sosa, Sánchez, & Angarita, 2018).

4.4 Existing CIMS technologies

PMBOK or Book of Standards for Project Management (Project Management Body of Knowledge): it is an internationally recognized standard. It works with the use of knowledge, skills, tools, and techniques to solve project requirements (Pmbok Guide, 2000).

PMBOK is a strategy for the organization of projects of construction and supervision of projects, which seeks to reduce losses and increase profits, focusing on eliminating activities and processes that do not have any value and optimizing those that do (Pmbok Guide, 2000).

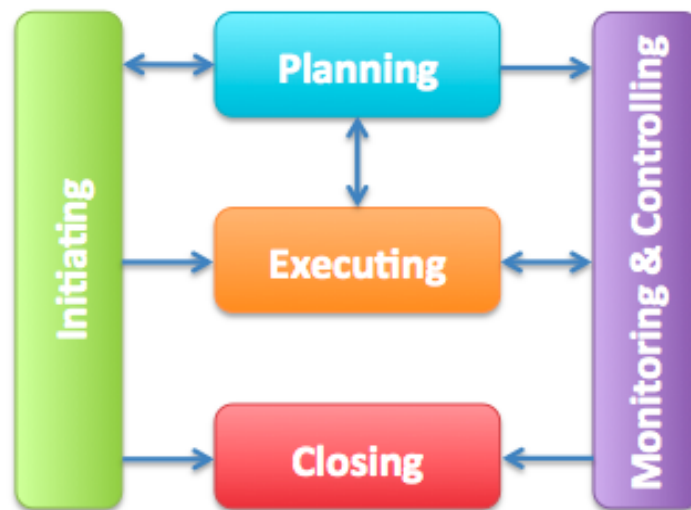


Image 7. Project Management Process Groups & Interaction Flow. Source: (PMBOK,2008).

Many project management techniques and standards have been developed in accordance with the variety of tasks and the environment in which they were created. The main standards of the project. The management includes, for example, PMI, IPMA, PRINCE2® and, to a certain extent, ISO 10 006. The basic philosophy to address problem-solving is very similar and the difference is only in the point of view of the solution area.

PMI is a professional association of companies and individual project managers. It is an American company that creates and maintains the PMBoK® standard. As with the British PRINCE2® standard and ISO 10 006, this is a concept of the process of problems of management of projects. This process corresponds to what we have described in the previous chapters on Construction information management systems (CIMS).(Scott et al., 2012).

There is no entity or legislation that controls the use of the methodology for Colombia, there are organizations such as the Colombian Chamber of Construction (CAMACOL), and the Colombian Council for Sustainable Construction (CCCS) with permanent courses to promote the methodology and its guidelines and management strategies.

PMBOK is the management guide of common practices for the development of projects: start, planning, execution, monitoring - control and closure. Which gives off 9 areas of knowledge, looking for time and cost savings. On the other hand, it is appreciated that the Pmbok tries to find the time and cost savings in the execution of projects, which involves the greatest efficiency to reduce cost overruns and time in the realization of the projects. Here you can enter Pmbok's time management, complemented by the Lean JIT (Just in time) philosophy in search of compliance with the final acceptance of the project. This process corresponds to what we have described in the previous chapters on Construction information management systems (CIMS).(Scott et al., 2012).

"Web-based information system to improve the management of civil works contracts was based on improving the management of civil works contracts, through the implementation of the web information system, to be able to monitor the works which are in execution.

The research and progress already made by the entities mentioned above only strengthen the idea that the monitoring and control of civil works is increasing and that the online tools are better and more indispensable every day to solve the most common problems until the lack of planning and correct execution, so we invite you to consider the need to implement an online system to unite and segment the multi-work project for the company GYR CONSTRUCCIONES SAS.

5. METHODOLOGY

Through the general objective, it is possible to understand that an online information system will be carried out for the verification, control, and monitoring of activities in different places but in a single information register. For which a set of components, elements, and activities that will develop in a simple but practical way an efficient solution for civil works projects of the company GYR CONSTRUCCIONES S.A.S.

5.1. Find a database of free mode.

Due to the different types of software, it is essential to find and choose one that is of complete reliability and compatibility that the company GYR CONSTRUCCIONES SAS works as this will guarantee the proper work of the administrative part with respect to the executive. The possibility of using Google software better known as "Google sheets" was evaluated since it also has an important version of cell formulas and functions, however it was found that the best possibility was offered by Microsoft Excel for having great experience in the sheet market calculation so it was necessary to work from the free cloud provided by Microsoft. It contains a basic and sufficient storage capacity to work with our proposal. To use Excel Online it is necessary to have an email account of one of the Microsoft services such as Hotmail, Live or Outlook, although today all these services have been integrated under the Outlook.com platform.

Once you provide your email account and password you should pay attention to the top horizontal bar and click on the drop-down menu that is located to the right of the Outlook.com title.(Moisés Ortiz, 2011)

As soon as you click, several options will be shown that will allow you to work with the new Office Online among which we find Excel Online.

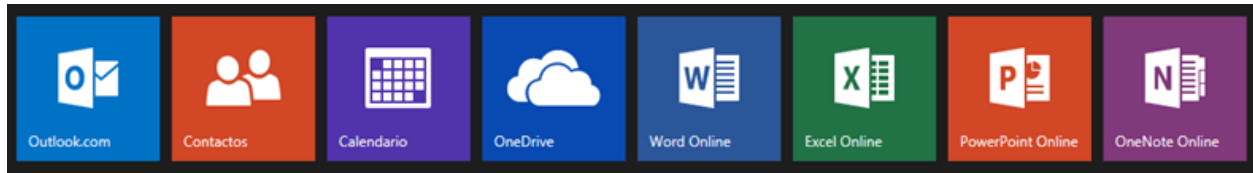


Image 8. Oficce Online Among. Source: own development

5.1.1. Excel online main screen

Once we create a new blank workbook, the initial Excel Online screen will be displayed, which is very similar to the interface we know about the tool.

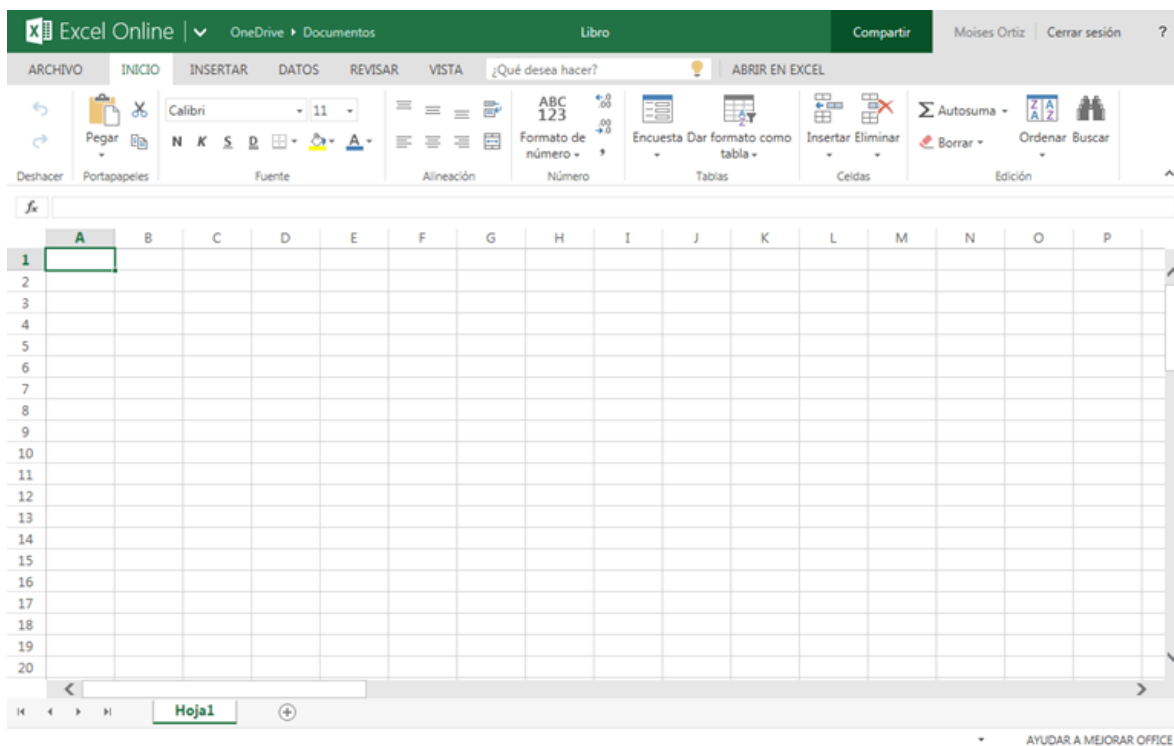


Image 9. Excel online main screen Source: own development

5.1.2. Excel books online kept

Excel Online is a version of the spreadsheet that runs from the cloud (Internet) and therefore the files we create will also be stored online. Microsoft's cloud storage service is known as OneDrive with up to 7GB to store any type of file.

Excel Online files are automatically saved in the OneDrive account and can only be accessed by the company, but it is possible to share the files with company contacts or make them visible to anyone. In this case it has been shared with the work residents of each work front and the management and construction manager of the company GYR CONSTRUCCIONES SAS. By using Excel Online you can access your documents by clicking on the OneDrive> GYR CONSTRUCCIONES SAS link located on the top bar:

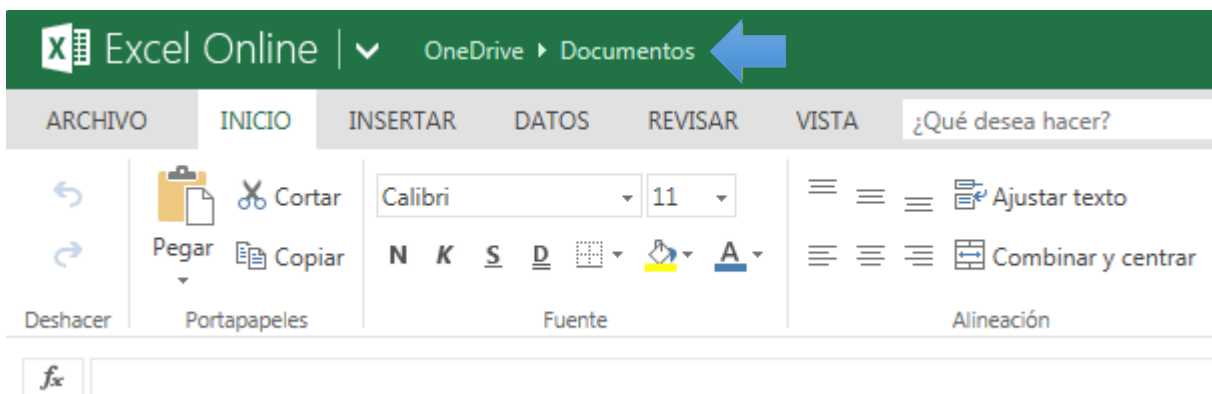


Image 10. Document access from excel. Source: Own development

When you open the GYR CONSTRUCCIONES SAS folder, you can perform actions on the files such as changing their name, moving them to a new folder, copying them, or deleting them.

Another way to access stored documents is to enter the OneDrive service.

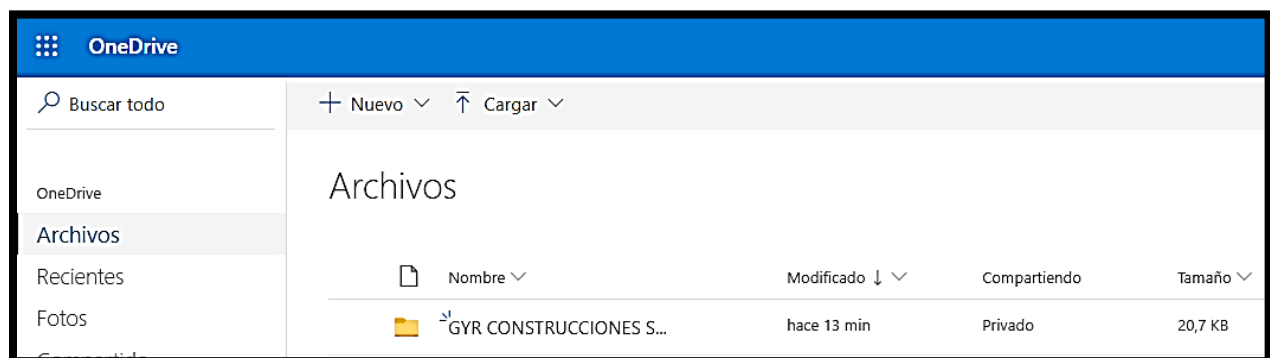


Image 11. GYR CONSTRUCCIONES SAS folder. Source: Own development

5.1.3. Share the workbooks” formato control de avance de obra” of excel online.

To share an Excel workbook you can click on the Share link located on the far right of the top bar of Excel Online. Clicking on this link will open a dialog box that will indicate the email of the people with whom you will share the document:

You can also share a document from OneDrive and for that you must select the file and click on the Share menu option.

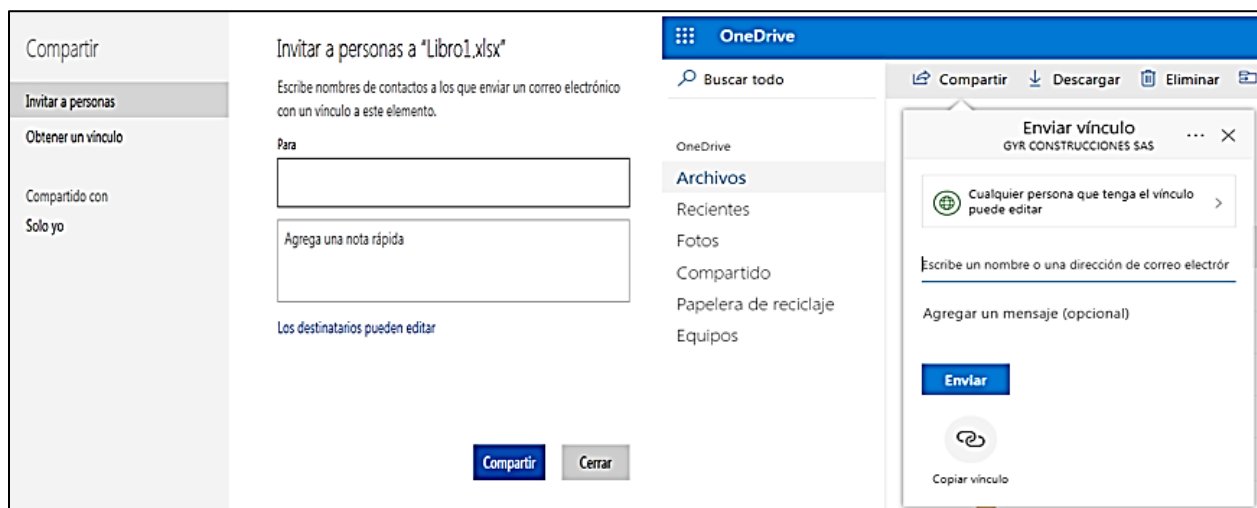


Image 12. How to share the folder. Source: Own development

5.1.4. Open a workbook directly in Excel.

It is likely that after you have created an Excel workbook in the cloud you decide to open it on your computer to continue editing. To open a workbook created with Excel Online in your Excel desktop version you must click on the Open in Excel link to the right of the “What do you want to do?” Box that is at the same time to the right of the tabs:

As you might suppose, it is also possible to open a workbook directly in Excel from OneDrive and for that you can right click on the workbook, and when the pop-up menu is displayed, select the Open in Excel option:

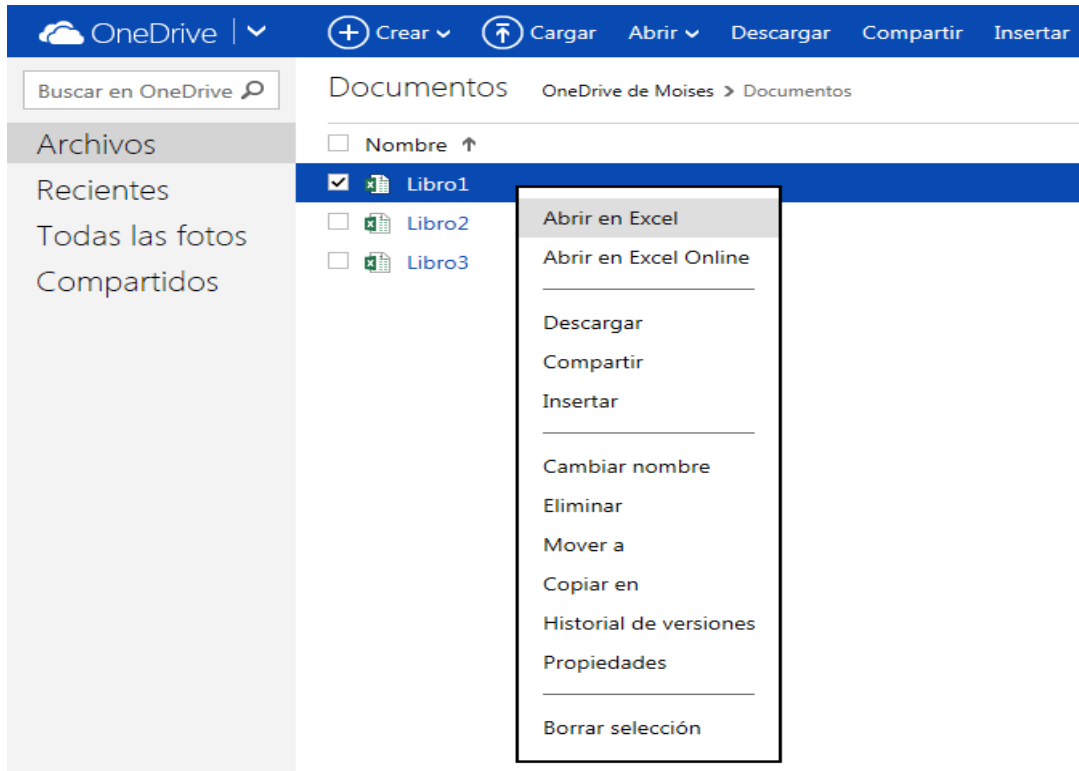


Image 13. How to open the main folder. Source: Own development

When Excel is opened, the user and password of your Microsoft account will be requested to have direct access to the file stored in OneDrive and that way every time you save any changes it will be stored directly in the cloud. If instead of modifying the online version of the Excel workbook you want to have a local copy on your computer then you can use the Download menu option and that version will be totally independent of the version stored in OneDrive.

5.1.5. Save in onedrive from Excel.

You can also use Excel to save directly to your OneDrive account. All you have to do is go to the File tab and select the Save and send option and then the Save on the Web option where you must log in with your Microsoft account and then save your Excel file directly in the cloud.

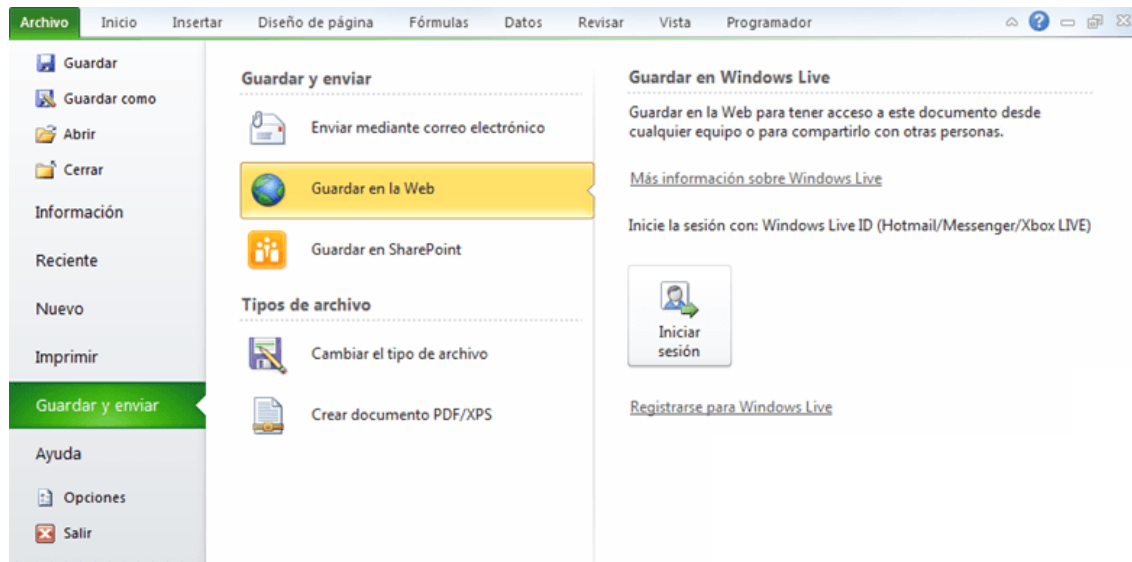


Image 14. How to save in the cloud. Source: Own development.

Once you have saved the file in OneDrive you can open it using Excel Online or you can also reopen it directly in Excel as it was shown in the previous section.

5.2. Create an interactive spreadsheet.

So in this way, daily monitoring of contractual activities of each project will be carried out in an online editable spreadsheet. This will be created in the software of free mode "Spreadsheets" or software of easy mutual access like Excel. Several spreadsheets will be needed to reach the

objective and sufficient knowledge to carry out the interaction between each one and the most accessible way to enter information in the spreadsheet. When finding the database, it will be necessary to work hand in hand with the technical direction of the work and the project direction of the university, in order to receive the best advice and that can be reflected in the interactive document.

In order to create an appropriate spreadsheet, several aspects that management usually requests for all types of projects have been evaluated, such as:

5.2.1. Work contract. In addition to having a basic knowledge of the location of the contract it is important to know the numbering or identification of the contract that the contracting company has towards GYR CONSTRUCCIONES SAS. This is why the work contract number and its corresponding name are included.

5.2.2. Name of who is responsible for the execution of the contract. While it is the management of the company that is directly involved in the acquisition of new construction contracts, we have the job resident's role as crucial and primary in this format. Since it is he who knows firsthand their progress with respect to those hired. Therefore, having a manager will better understand where the information comes from and there will be a person in charge of the data entered into the system.

5.2.3. Dates of beginning and termination of the contract. They serve as a reference to the entire work team to continue working with the work schedule and request an additional time if necessary. It also sets the standard to start with the monthly reports of each work.

5.2.4. Contractual Amounts. This information is included in order to know what kind of activities have been contracted and what amounts were agreed upon upon acquiring the contract. This information is composed of: item number, activity description, unit of measure, total amount. The contractual information becomes the basis for the correct development of a work progress control, since it allows a control of the missing amounts to be executed with respect to the time remaining in the contract.

5.2.5. Activity progress log. With the idea of keeping a control and monitoring of the contractual, the condition is introduced that the information must be filled in a minimum period of time since these contracts are quick to execute and liquidate. Therefore, the weekly period is proposed as the most appropriate due to the progress seen in other and current situations of GYR CONSTRUCCIONES SAS. It is important to include a way to track what is executed.

5.3. Socialization and training to the human resource of the company

It is necessary to work later with a group of professionals or work residents, to agree on the handling of the information and the use of the platform on which it is proposed to work. This part is indispensable since the most important resource of a company is the human resource. Daily updates will be made of each activity carried out on the site according to what was contracted before the start of the contract and based on these same quantities and specifications. This part is fundamental as the culmination of the entry of the information to the database since no one else in the company knows the details of the progress and planning of each project that the residents of the work.

Different efforts were made to understand the needs of the work residents and were taken into account for the elaboration of the spreadsheet, since it was stated on several occasions that the progress of work depends on many factors among which we find: climatic aspects, availability of materials, opening of new work areas, supervision recommendations, as well as the workforce's own performance. So when proceeding with said training of the work residents, it was necessary to do it individually; that is, starting in each work.

5.3.1 Peñazul la Aldea work, Marval.

Training work began with Girardot's work where internal urban planning works were carried out in Marval's work, where activities were carried out for just over 2 years until the termination of contractual amounts. Under the following description:

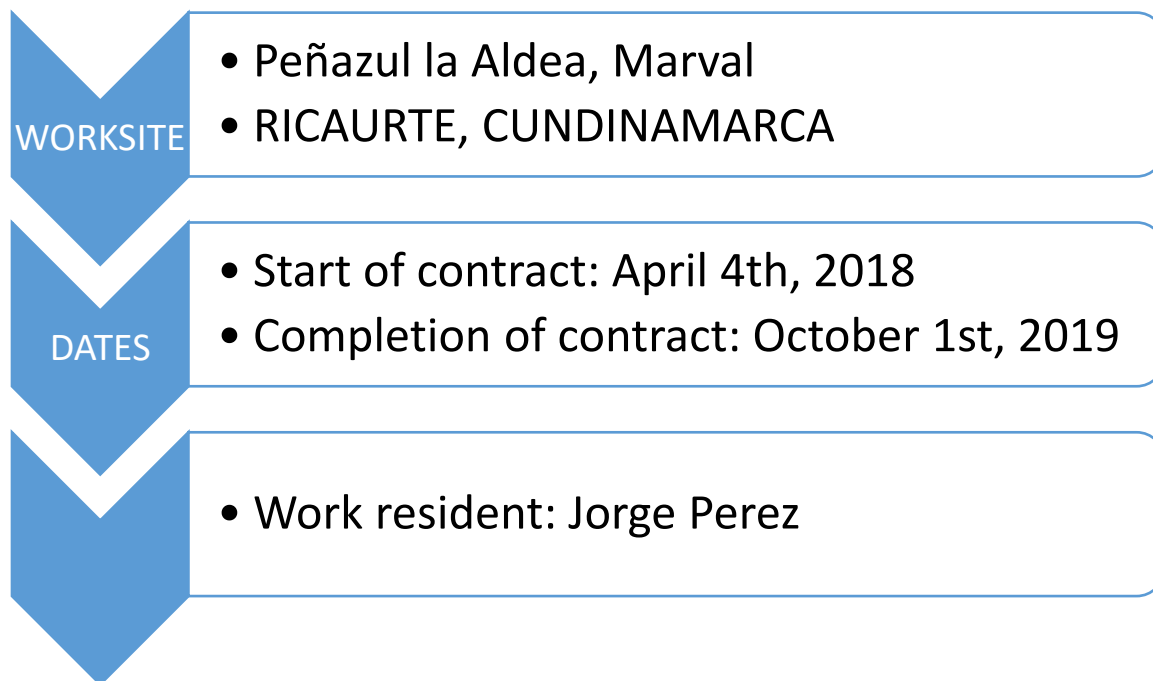


Figure 1. Peñazul la Aldea information. Source: own development

The following are some of the most significant activities of the contract that were followed up with the system.

Table 1 Peñazul work amounts. Source: Own development.

ITEM	DESCRIPCION	UND	CANT
1	ESTRUC VÍAS Y ANDENES		
1,01	Excavación transporte cajeo vía frente a torre 2-3.	M3	2062,68
1,02	Mano de Obra Instalación Geo textil.	M2	11233,07
1,03	Suministro e instalación B400 vía.	M3	1684,97
1,04	Suministro e instalación B600 vía e=20 cm.	M3	2134,29
1,05	Mejoramiento -Suministro Sello en Recebo Común.	M3	561,66
1,06	Mejoramiento -Suministro e Instalación Rajón.	M3	2808,27
2	ESTRUC VÍAS Y ANDENES		
2,01	M O Instal Adoquín + arena Peatonales rojo	M2	1.885,28
2,03	M O Instal Adoquín + arena Vehicular Ecológico	M2	7.227,76
2,04	Suministro e instalación B400 andenes e=20 cm	M3	483,24
2,05	Bordillo fundido en sitio (incluye formaleta) vías	ML	1.634,98
3	RED SANITARIA		
3,01	Pozos de inspección Aguas Servidas M.O Realce de 20 a 30 cms.	UN	10,00
3,02	Tubería NVF 400 mm o 16" A.LL. (Pozo 4 a pozo 13) por instalar	ML	32,50
3,03	M.O Bordillo fundido en sitio (incluye formaleta) andenes	ML	3.228,03
3,04	M.O Instalación Tubería de 4" domiciliarias	ML	29,20
3,06	M.O Construcción Cajas de Inspección en concreto 80x80	UN	34,00
3,07	M.O Instalación codos a 45°	UN	35,00
3,08	M.O Instalación Silla Yee de 160 mm a 200 mm	UN	35,00
3,09	Excavación con disposición final	M3	806,30
3,10	Relleno en material seleccionado	M3	396,00
4	RED PLUVIAL		
4,01	Pozos de inspección Aguas Lluvias O Realce de 20 a 30 cms.	UN	13,00
4,02	M.O Sumidero SL-200 Incluye Formaleta	UN	31,00
4,03	Tubería NVF 355mm o 14" A.LL. (de sumideros a pozos)	ML	232,00
4,04	M.O Construcción de Filtro francés 50 x40	ML	446,90
4,05	M.O Construcción Cajas de Inspección	UN	35,00
4,06	M.O Instalación Silla yee de 400mm a 200mm	UN	2,00
4,07	M.O Instalación de tubería de 160 mm	ML	196,00
5	RED ACUEDUCTO		
5,01	EXCAV RED ACUED-RCI	M3	756,66
5,08	R18-,058-ACOMETIDA TORRES	UN	8,00
5,09	INST SIAMESA	UN	1,00
5,10	CAJA TOTALIZADORA	UN	3,00
5,11	VALVULA RED ACUE	UN	2,00
5,12	CAJA VALVULA	UN	11,00
5,13	FILTRO PERIMETRAL TANQUE	ML	93,65
5,14	RELLEN FILTRO TANQUE	M3	11,24

En el contrato Peñazul de Ricaurte Cundinamarca, se realizaron labores de urbanismo interno propios de la constructora Marval en donde el coordinador de obra Jorge Pérez se encargó de ejecutar el contrato con maquinaria, mano de obra y recursos de la empresa. Dichos esfuerzos dieron con el resultado de más de 13 meses de trabajo continuo en la ejecución de las siguientes actividades. Sin embargo, como se ha evidenciado antes la gerencia y el director tienen una apremiante necesidad de conocer avances de obra diaria o semanal por lo que acuden a llamadas telefónicas o visitas constantes con el fin de cuantificar cantidades de obra ejecutada junto con el coordinador y así proceder con la elaboración de actas de obra. A pesar de que este método suele ser muy confiable demanda de mucho tiempo de parte de la dirección de obra, así que se propuso el sistema en línea que puede actualizarse semanalmente y que direcciona a la empresa a seguir modelos de gran escala de tipo CIMS. En los últimos meses de la ejecución de dicho contrato se contó con la ayuda del sistema elaborado por el pasante, lo cual permitió una reducción en el número de visitas de la dirección de obra así como una elaboración más eficiente de las actas y cortes de obra para un pago más pronto y concluyente.

5.3.2. Sala de Ventas, Prodesa.

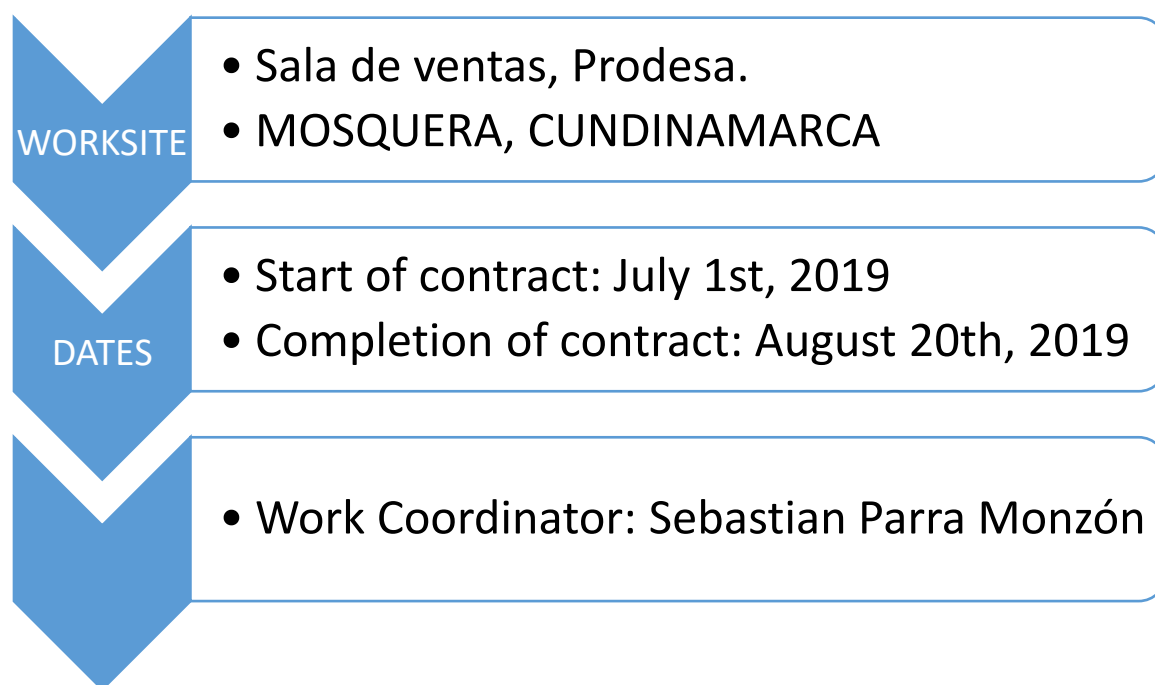


Figure 2. Sala de ventas. information. Source: own development

Las siguientes son algunas de las actividades más significativas del contrato al que se le hizo seguimiento con el sistema.

Table 2. Sala de ventas Amounts. Source: own development.

ITEM	DESCRIPCIÓN	UND	CANT
1	PRELIMINARES LOTE AREA 1.225 M2		
1,1	UBICACIÓN, LOCALIZACION Y REPLANTEO.	M2	917,50
2	MOVIMIENTOS TIERRA-VIA INGRESO PARQUEADERO Y SALA DE VENTAS		
2,1	EXCAVACION MECANICA CON RETIRO EXTERNO, E=0,30.	M3	275,25
2,2	SUMINISTRO E INSTALACION RECEBO B-200, E =0,30 CON PENDIENTES	M3	367,50
2,3	SUMINISTRO E INSTALACION TRITURADO DE 3/4", E=0,05 - A=437,50 M2.	M3	21,87
2,4	SUMINISTRO E INSTALACION TRITURADO DE 3/4" E= 0,05 - A= 480 M2.	M3	24,00

2,5	TUBERIA NOVAFOR DE 250 mm	ML	120,00
2,6	EXCAVACION MECANICA CON RETIRO EXTERNO.	M3	108,00
2,7	RELLENO CON MATERIAL DE EXCAVACION.	M3	90,00
2,8	CAJA INSPECCION DE 0,70*0,70	UND	1,00

Para la sala de ventas de Mosquera que fue de rápida ejecución se tomaron un conjunto de actividades iniciales que a medida del tiempo se fueron modificando o aumentando debido a las preferencias del cliente, así que las actividades contractuales terminaron siendo totalmente diferentes a las iniciales. Así que se propuso con autorización de la dirección de obra agregarlas al formato de avance así no estuvieron vinculadas aun en las actividades contractuales. Esto sirvió para llevar un control semana a semana de que actividades se iban solicitando y con qué velocidad se iban ejecutando.

5.3.3. Reservas de Madrid, Prodesa.



Figure 3. Reservas de Madrid information. Source: own development

Las siguientes son algunas de las actividades más significativas del contrato al que se le hizo seguimiento con el sistema.

Table 3. Reservas de Madrid work amounts. Source: Own development

ITEM	DESCRIPCION	UND	CANT
Estruja vías y andenes			
7,010	Suministro geo textil no 1.600 etapa 02 calle 15 a v-14	M2	3.730,00
7,020	Instalación geo textil nt 1.600 etapa 02 calle 15 a v-14	M2	3.730,00
7,030	Excavación a máquina caja vías etapa 02 calle 15 a v -14	M3	2.180,98
7,040	Disposición a botadero retiro materiales excavación etapa 02 calle 15	M3	2.180,98
7,029	Suministro geo textil t 2.100 sumideros calle 15	M2	2.579,15
7,030	Instalación geo textil t 2100 sumideros calle 15	M2	2.579,15
7,031	Suministro geo textil nt 1.600 etapa 04 calle 15 v-14	M2	3.804,70

7,032	Instalación geo textil nt 1.600 etapa 04 calle 15 v-14	M2	3.804,70
7,033	Excavación a máquina caja vías etapa 04 calle v -14	M3	2.322,01
7,034	Disposición a botadero retiro materiales excavación etapa 04 calle	M3	2.322,01
7,035	Suministro e instalación sub-base granular b-400 etapa 04 calle v -14	M3	1.034,30
7,080	Suministro e instalación b-400 red sumideros calle 14	M3	94,50
7,081	Excavación manual zanja 0 a 0,50 red sumideros calle 14	M3	153,00
7,082	Disposición a botadero retiro materiales excavación zanja	M3	153,00
7,083	Suministro tubería novador d=0,25m sumideros calle 14	ML	180,00
7,084	Instalación tubería novador d=0,25m sumideros calle 14	ML	180,00
7,085	Suministro geo textil t 2.100 sumideros calle 14	M2	1.383,80
7,086	Instalación geo textil t 2100 sumideros calle 14	M2	1.383,80
7,102	Mano de obra cenefa doble adoquín construcción anden	ML	377,45
7,103	mano de obra concreto reforzado color 10cm construcción anden	M2	46,03
7,104	Mano de obra concreto estampado salado 10cm construcción anden	M2	738,14
7,105	Construcción sumidero andenes	UN	7,00
7,106	Suministro e instalación triturado de 3/4" red sumideros vía al parque	M3	18,08
7,110	Suministro e instalación b-400 red sumideros vía al parque	M3	55,12
7,111	Disposición a botadero retiro materiales excavación red sumideros vía	M3	89,25
7,126	Disposición a botadero retiro materiales excavación etapa 04 calle	M3	492,81
7,127	Suministro e instalación b-400 etapa 04 calle v-14	M3	328,54
7,138	Instalación geo textil t 2100 parque lineal	M2	2.167,20
7,139	Imprimación emulsión asfáltica crr-1 (rotura rápida) parque lineal	M2	1.548,00
7,140	Suministro e instalación base asfáltica mdc-1 parque lineal	M3	123,84
7,141	Mano de obra bordillo bloque concreto 20*10*100 parque lineal	ML	996,65
7,142	Mano de obra solado limpieza concreto 1.500 e=0,03 parque lineal	M2	1.821,06

Para llevar a cabo la conformación de la vía se realizaron diferentes reuniones con la interventoría y la parte contratante, ya que por aspectos técnicos era necesario reevaluar la estructura propuesta. Además de la elaboración de planes y metas para desarrollar este proyecto fue necesario la visita de especialistas en suelos y pavimentos, tras lo cual se desarrolló un concepto profesional que fue acatado por el ente contratante y GYR CONSTRUCCIONES SAS. Este proyecto fue el más involucrado en la pasantía del estudiante ya que estuvo desde su comienzo hasta su finalización, además se utilizó ampliamente el formato de avance de obra propuesto por el pasante.

5.3.4. Alcalá, Mosquera; Prodesa.

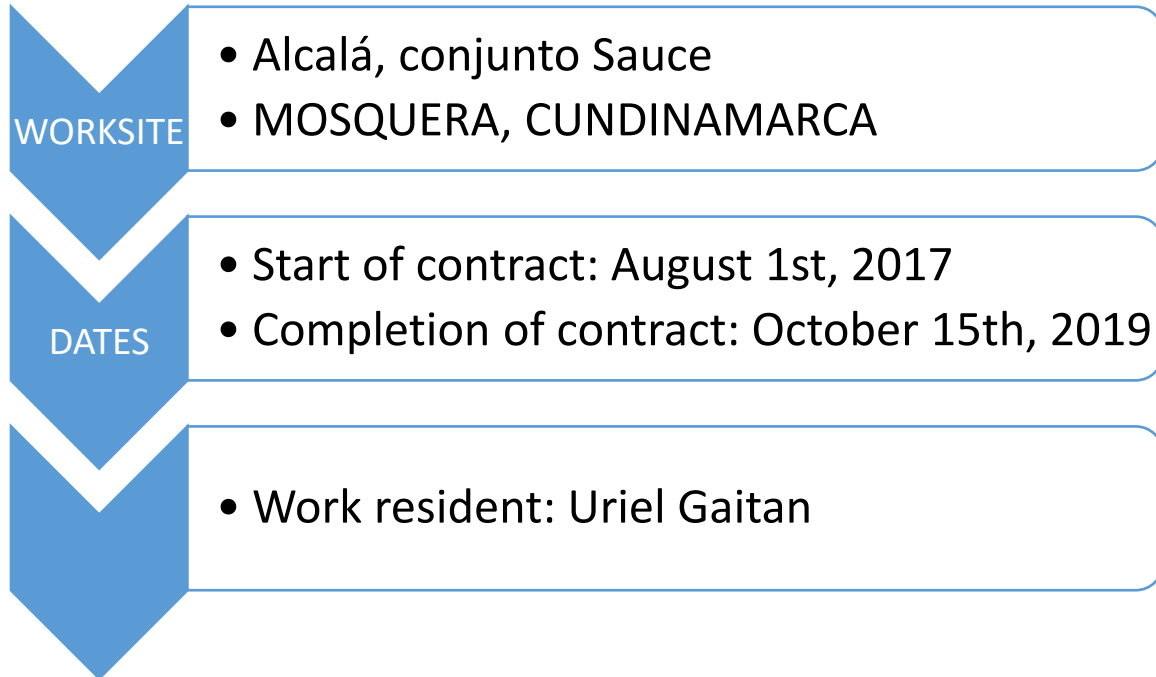


Figure 4. Alcalá information. Source: own development

Table 4. Alcala work amounts. Source: Own development.

ITEM	DESCRIPCION	UND	CANT
4	REDES ACUEDUCTO U.I.		36.703,75
4,01	Caja Medidor Totalizador 3"	Un	1
4,02	Recebo Común B-200 Zanjas	m3	4,03
4,03	Recebo Común B-200 Zanjas	m3	2,34
4,04	Suministro y Colocación Arena de Peña	m3	69,75
5	5-REDES AGUAS LLUVIAS U.I.		
5,01	Suministro e Instalación Tubería Novador d=0.16m	m	80,91
5,02	Suministro e Instalación Tubería Novafort d=0.16m	m	46,98
5,03	Suministro e Instalación Tubería Novafort d=0.20m	ml	124,93
6	6-REDES AGUAS RESIDUALES U.I.		
6,01	Suministro e Instalación Tubería Novafort d=0.31m	ml	33,79
6,02	Suministro e Instalación Tubería Novafort d=0.31m	ml	19,62
6,03	Suministro e Instalación Tubería Novafort d=0.25m	ml	80,6
6,04	Suministro e Instalación Tubería Novafort d=0.25m	ml	46,8

7	7-REDES CONTRAINCENDIO U.I.		
7,01	Excavación Zanjas Tubería	m3	58,92
7,02	Excavación Zanjas Tubería	m3	34,21
7,03	Recebo Común B-200 Zanjas	m3	6,55
14	14-REDES GAS NATURAL U.I.		
14,01	Excavación Zanjas Tubería	m3	75,92
14,02	Excavación Zanjas Tubería	m3	44,08
14,03	Suministro y Colocación Arena de Peña	m3	37,92
14,04	Suministro y Colocación Arena de Peña	m3	22,08
15	15-ANDENES U.I.		
15,01	Excavación Mecánica con Retiro	m3	126,15
15,02	Relleno Cielo Ab Rajón	m3	36,29
15,03	Súbase Granular B-400	m3	45,36
15,04	Suministro y Colocación Base Granular - INVIAS BG-1	m3	45,36
15,04	Suministro y Colocación Sello Granular - Recebo Común	m3	36,29
19	19-VIAS VEHICULARES U.I.		
19,01	Excavación Mecánica con Retiro	m3	1.046,26
19,02	Relleno Cielo Ab Rajón	m3	300,98
19,03	Súbase Granular SBG 1 TIPO INVIAS	m3	526,71
19,04	Suministro y Colocación Base Granular - INVIAS BG-1	m3	300,98
20	20-REDES RIEGO U.I.		
20,01	Suministro e Instalación Tubería PVC 1-1/2"	m	93,93
20,02	Suministro e Instalación Tubería PVC 1-1/2"	m	54,54
20,03	Registro PD 1-1/2"	Un	2,00

5.4. Socialization of the information system with the administrative and operational management of the company

When the information reaches the management of the company and the project management, the objective is reached since an accessible system is implemented for the whole company, in which a list of activities related to the different projects can be visualized and all this in real time. The management of the company will have the opportunity to monitor and control the development and progress of the project and at the same time have more time for the planning and organization of these projects. Be socialized with management about the use of this information and how to access it. The construction manager will have the opportunity to work more with the

resident of the building by knowing the daily information of the contract in execution and its due alignment with the schedule and delivery parameters to the auditing.

In addition to the operational part, it is essential to have the administrative part of the company GYR CONSTRUCCIONES SAS for which it was proposed to carry out meetings in the office to discuss the importance of controlling and monitoring the work activities.

The construction management contributed several ideas about the online format that began to be used, implementing specific folders in the “onedrive” where the photographic record of the activities reported in the format is left. That is to say that in this way they can make partial cuts of work or reports directly from the format.

6. RESULTS

Through this project of a degree in an internship, the mode was expected to implement the most appropriate online information format as a tool for the work of the company GYR CONSTRUCCIONES SAS with which to consolidate technical and administrative processes more forceful and efficient before the audit and contracting entity. As well as the construction of a correct contracting relationship - contractor and excellent commercial relations.

When working with the administrative and operational parts of the company GYR CONSTRUCCIONES SAS, it has been evidenced the need to obtain a communication channel of its own and with special characteristics based on (Scott et al., 2012). That serves as a platform for the processes of collection and delivery of company activities.

The contract with which it had the most development and control with the online advance format was the 15th Street of the “Madrid Reserves” work, in which typical element installation activities of a track were executed as well as the conformation of concrete platforms and cobblestone. Although the route was budgeted to end in 2020 according to the schedule and budget requested by Prodesa, it was evidenced by the contracting party as well as the intervention that was worthwhile to execute the work in its entirety to give road access to the construction process of the other parts of the work. Therefore, a positive result found in the student's internship was the constant meetings and correct communication through minutes with

the interested parties of the contract and a correct follow-up to the execution of the contract.

CONSOLIDADO DE ACTIVIDADES G Y R CONSTRUCCIONES SAS

Obra: CONSTRUCCION VIAS CALLE 14 Y 15
22740001

No. Contrato: GYR CONSTRUCCIONES SAS

Contratista: RESIDENTE URIEL GAITAN

Elaborada por:

Fecha de Inicio: 3-may-19

% Avance general: 98,3%

El residente de obra tendra como responsabilidad editar solo los espacios delineados con este color.

El residente no debe editar las casillas de este color ya que esta labor estara a cargo de la parte administrativa del contrato.

CANTIDADES CONTRACTUALES			CONTROL AVANCE DE OBRA													Avance previsto					
Item	Descripción	UM	Cantidad Total	Total Cuantitativo	Total Porcentaje	% Avance	3-ago-19	9-ago-19	15-ago-19	22-ago-19	29-ago-19	5-sep-19	12-sep-19	19-sep-19	26-sep-19	3-oct-19	10-oct-19	17-oct-19	24-oct-19	31-oct-19	
7.010	suministro gestado 1.2.100 etapa 02 calle 15 a v-14	M2	3.730,00	3.730	0	100,0%	1650,9	0	0	0	0	550	712	223,7	336	237,4	0	0	0	0	0
7.020	instalacion gestado 1.2.100 etapa 02 calle 15 a v-14	M2	3.730,00	3.730	0	100,0%	1650,9	0	0	0	0	550	712	223,7	336	237,4	0	0	0	0	0
7.030	instalacion a maquinaria capa via etapa 02 calle 15 a v-14	M3	2.180,98	2180,98	0	100,0%	950,28	0	0	236,5	225,3	336	201,6	150,2	75,33	5,77	0	0	0	0	0
7.040	disposicion a instalacion video monitoreo en camaron etapa 02 calle 15 a v-14	M3	2.180,98	2180,98	0	100,0%	950,28	0	0	236,5	225,3	336	201,6	150,2	75,33	5,77	0	0	0	0	0
7.050	suministro e instalacion sub-base granular b-400 etapa 02 calle 15 a v-14	M3	957,08	957,08	0	100,0%	444,2	0	0	0	0	68,2	242,3	122	62	38,38	0	0	0	0	0
7.060	suministro e instalacion base granular b-400 etapa 02 calle 15 a v-14	M3	797,56	797,56	0	100,0%	352,25	0	0	0	0	47,2	125,5	102,2	75,38	95,03	0	0	0	0	0
7.070	suministro e instalacion base asfaltica m3-1 etapa 02 calle 15 a v-14	M3	223,39	219,45	3,94	98,2%	112,15	0	0	0	0	0	0	0	0	0	65,3	42	0	0	0
7.080	suministro e instalacion rodadura asfaltica m3-2 etapa 02 calle 15 a v-14	M3	197,54	197,49	0,05	100,0%	79	0	0	0	0	0	0	0	0	0	45,99	46,5	0	0	0
7.090	impronta en erudion asfaltica crr-1 (rotura repetida) etapa 02 calle 15 a v-14	M2	6.119,51	6016,3	103,21	98,3%	2680,1	0	0	0	0	0	0	0	0	1700,6	1523,3	112,3	0	0	0
7.100	instalacion señaliz prefabricada etapa 04 calle 15 a v-14	ML	781,50	761,2	0	100,0%	376	0	0	0	0	63,2	50	55,5	69,8	112,2	40,5	0	0	0	0
7.011	comestacion sumideros asfeticos	UH	12,00	12	0	100,0%	4	0	0	0	1	0	1	1	2	2	1	0	0	0	0
7.022	suministro e instalacion burlado de 3/4" red sumideros calle 15	M3	31,10	31,1	0	100,0%	12,5	18,6	0	0	0	0	0	0	0	0	0	0	0	0	0
7.023	suministro e instalacion b-400 red sumideros calle 15	M3	84,90	90,7	3,8	96,0%	35,5	35,2	20	0	0	0	0	0	0	0	0	0	0	0	0
7.024	instalacion manillar carga 0 a 0,50 red sumideros calle 15 0	M3	153,00	147,8	5,2	96,6%	70,3	52,3	15	10,2	0	0	0	0	0	0	0	0	0	0	0
7.025	disposicion a instalacion video monitoreo en camaron carga red sumideros	M3	153,00	147,8	5,2	96,6%	70,3	52,3	15	10,2	0	0	0	0	0	0	0	0	0	0	0
7.026	suministro tuberia macizo dn0,25m sumideros calle 15	ML	180,00	180	0	100,0%	88,5	44,2	22	25,3	0	0	0	0	0	0	0	0	0	0	0
7.027	instalacion tuberia macizo dn0,25m sumideros calle 15	ML	180,00	180	0	100,0%	88,5	44,2	22	25,3	0	0	0	0	0	0	0	0	0	0	0
7.028	mano de obra extendido y acorapado concreto calle 15	M2	123,87	123,8	2,27	98,2%	65,3	0	0	0	0	0	0	0	0	0	0	0	0	0	56,3
7.029	suministro gestado 1.2.100 sumideros calle 15	M2	2.579,15	2531,05	48,1	98,1%	1114,2	736	550,2	130,65	0	0	0	0	0	0	0	0	0	0	0
7.030	instalacion gestado 1.2.100 sumideros calle 15	M2	2.579,15	2531,05	48,1	98,1%	1114,2	736	550,2	130,65	0	0	0	0	0	0	0	0	0	0	0
7.031	suministro gestado m 1.600 etapa 04 calle 15 a v-14	M2	3.804,70	3472,69	332,01	91,3%	1502,6	0	0	0	0	0	0	0	0	0	785,36	365,2	563,3	256,23	256,23
7.032	instalacion gestado m 1.600 etapa 04 calle 15 a v-14	M2	3.804,70	3472,69	332,01	91,3%	1502,6	0	0	0	0	0	0	0	0	0	785,36	365,2	563,3	256,23	256,23
7.067	mano de obra extendido y acorapado concreto calle 15	M2	115,17	115,8	1,37	98,8%	75,3	0	0	0	0	0	0	0	0	0	0	0	0	15,3	23,2
7.064	suministro e instalacion base asfaltica mod-1 construcciones via	M3	230,47	230,47	0	100,0%	132,3	0	0	0	0	0	0	0	0	0	0	0	0	98,17	0
7.065	suministro e instalacion rodadura asfaltica mod-2 construcciones via	M3	172,80	168,4	8,45	95,1%	73,6	0	0	0	0	0	0	0	0	0	0	0	0	78,8	12

Image 15. Online format. Source: Own development

The first part of the format is the contractual activities, which represent the agreed items for immediate execution with the contractor. What is evidenced in Table No. 1 is a list of “items” with their respective description and unit of measure. It is important to be clear about this nomenclature due to the amount of activities that exist in the construction industry, since this would be your identification with the other parts of the contract. The amounts also correspond to what was agreed at the beginning of the contract, and is part of the basic information available to the work residents.

Table 5. First part of online format. Source: own development

CONSOLIDADO DE ACTIVIDADES G Y R CONSTRUCCIONES SAS

Obra:	CONSTRUCCION VIAS CALLE 14 Y 15
No. Contrato:	22740001
Contratista:	GYR CONSTRUCCIONES SAS
Elaborada por:	RESIDENTE URIEL GAITAN

CANTIDADES CONTRACTUALES

Ítem	Descripción	UM	Cantidad total
7,010	Suministro geo textil t 2,100 etapa 02 calle 15 a v-14	M2	3.730,00
7,020	Instalación geo textil t 2,100 etapa 02 calle 15 a v-14	M2	3.730,00
7,030	Excavación a máquina caja vías etapa 02 calle 15 a v -14	M3	2.180,98
7,040	Disposición a botadero retiro materiales excavación etapa 02 calle 15 a v -14	M3	2.180,98
7,050	Suministro e instalación sub-base granular b-400 etapa 02 calle 15 a v -14	M3	957,08
7,060	Suministro e instalación base granular b-600 etapa 02 calle 15 av-14	M3	797,56
7,070	Suministro e instalación base asfáltica mdc-1 etapa 02 calle 15 a v -14	M3	223,39
7,080	Suministro e instalación rodadura asfáltica mdc-2 etapa 02 calle 15 a v -14	M3	167,54
7,090	Imprimación emulsión asfáltica crr-1 (rotura rápida) etapa 02 calle 15 a v -14	M2	6.119,51
7,100	Instalación sardinel prefabricado etapa 04 calle 15 av-14	ML	761,20
7,021	Construcción sumidero anden	UN	12,00
7,022	Suministro e instalación triturado de 3/4" red sumideros calle 15	M3	31,10
7,023	Suministro e instalación b-400 red sumideros calle 15	M3	94,50
7,024	Excavación manual zanja 0 a 0,50 red sumideros calle 15 0	M3	153,00
7,025	Disposición a botadero retiro materiales excavación zanja red sumideros	M3	153,00
7,026	Suministro tubería novador d=0,25m sumideros calle 15	ML	180,00
7,027	Instalación tubería novador d=0,25m sumideros calle 15	ML	180,00
7,028	Mano de obra extendido y estampado concreto calle 15	M2	123,87
7,029	Suministro geo textil t 2.100 sumideros calle 15	M2	2.579,15
7,030	Instalación geo textil t 2100 sumideros calle 15	M2	2.579,15
7,031	Suministro geo textil net 1.600 etapa 04 calle 15 v-14	M2	3.804,70
7,032	Instalación geo textil net 1.600 etapa 04 calle 15 v-14	M2	3.804,70
7,087	Mano de obra extendido y estampado concreto calle 15	M2	115,17
7,094	Suministro e instalación base asfáltica mdc-1 construcción vía	M3	230,47
7,095	Suministro e instalación rodadura asfáltica mdc-2 construcción vía	M3	172,85

Table 6. Second part of online format. Source: own development

Fecha de Inicio:	01-may-19
% Avance general:	98,3%

CONTROL AVANCE DE OBRA			Avance previo	01-ago-19	08-ago-19	15-ago-19	22-ago-19	29-ago-19
Total Ejecutado	Total Pendiente	% Avance		S1	S2	S3	S4	S5
3730	0	100,0%	1650,9	0	0	0	0	550
3730	0	100,0%	1650,9	0	0	0	0	550

2180,98	0	100,0%	950,28	0	0	236,5	225,3	336
2180,98	0	100,0%	950,28	0	0	236,5	225,3	336
957,08	0	100,0%	444,2	0	0	0	0	68,2
797,56	0	100,0%	352,25	0	0	0	0	0
219,45	3,94	98,2%	112,15	0	0	0	0	0
167,49	0,05	100,0%	75	0	0	0	0	0
6016,3	103,21	98,3%	2680,1	0	0	0	0	0
761,2	0	100,0%	370	0	0	0	0	63,2
12	0	100,0%	4	0	0	0	0	1
31,1	0	100,0%	12,5	18,6	0	0	0	0
90,7	3,8	96,0%	35,5	35,2	20	0	0	0
147,8	5,2	96,6%	70,3	52,3	15	10,2	0	0
147,8	5,2	96,6%	70,3	52,3	15	10,2	0	0
180	0	100,0%	88,5	44,2	22	25,3	0	0
180	0	100,0%	88,5	44,2	22	25,3	0	0
121,6	2,27	98,2%	65,3	0	0	0	0	0
2531,05	48,1	98,1%	1114,2	736	550,2	130,65	0	0
2531,05	48,1	98,1%	1114,2	736	550,2	130,65	0	0
3472,69	332,01	91,3%	1502,6	0	0	0	0	0
3472,69	332,01	91,3%	1502,6	0	0	0	0	0
113,8	1,37	98,8%	75,3	0	0	0	0	0
230,47	0	100,0%	132,3	0	0	0	0	0
164,4	8,45	95,1%	73,6	0	0	0	0	0

After using the contractual activities, the format was organized in order to summarize the progress of the work in executed quantity and pending amount, as well as a percentage of progress that allows statistics on the processes.

As we can see in the example of Madrid, Cundinamarca, the amounts initially contracted were mostly executed. However, in certain activities the contract was not exhausted, which indicates the format as it does not have 100% progress in many of them. Which is positive for the experiment as it sums up broadly what resources were not executed and which required an additional amount.

Table 7. Third part of online format. Source: own development

5-sep-19	12-sep-19	19-sep-19	26-sep-19	3-oct-19	10-oct-19	17-oct-19	24-oct-19	31-oct-19
S6	S7	S8	S9	S10	S11	S12	S13	S14
712	223,7	356	237,4	0	0	0	0	0
712	223,7	356	237,4	0	0	0	0	0
201,6	150,2	75,33	5,77	0	0	0	0	0
201,6	150,2	75,33	5,77	0	0	0	0	0
242,3	122	62	18,38	0	0	0	0	0
47,2	125,5	102,2	75,38	95,03	0	0	0	0
0	0	0	0	0	65,3	42	0	0
0	0	0	0	0	45,99	46,5	0	0
0	0	0	0	1700,6	1523,3	112,3	0	0
50	55,5	69,8	112,2	40,5	0	0	0	0
0	1	1	2	2	1	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	56,3
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	785,36	365,2	563,3	256,23
0	0	0	0	0	785,36	365,2	563,3	256,23
0	0	0	0	0	0	15,3	23,2	0
0	0	0	0	0	0	0	98,17	0
0	0	0	0	0	0	0	78,8	12

After using the work progress, there is a weekly control of quantities that in this case served to show that it is enough to edit the amount of contract items with the amount executed of each of them, this in turn feeds the previous section described in Image 1 summarizing in separate boxes, how much is left to finish executing said activity.

The way of entering the data turned out to be beneficial for the residents of the work since being a consolidated weekly, and not daily allows to make a summary of specific activities that have commitments of execution with the other parties. The residents felt comfortable updating and

keeping track of the activities, which is understood as one of the main results, since it simplifies the action of reporting to the construction management the weekly and monthly work progress.

Giving, as a result, a descriptive document with investigative characteristics about the process and resources as well as the conclusions found after the implementation of the tool previously proposed.

Some of the most important activities performed by the intern are described below:

6.1 Construction process supervision under the direction of the resident engineer.



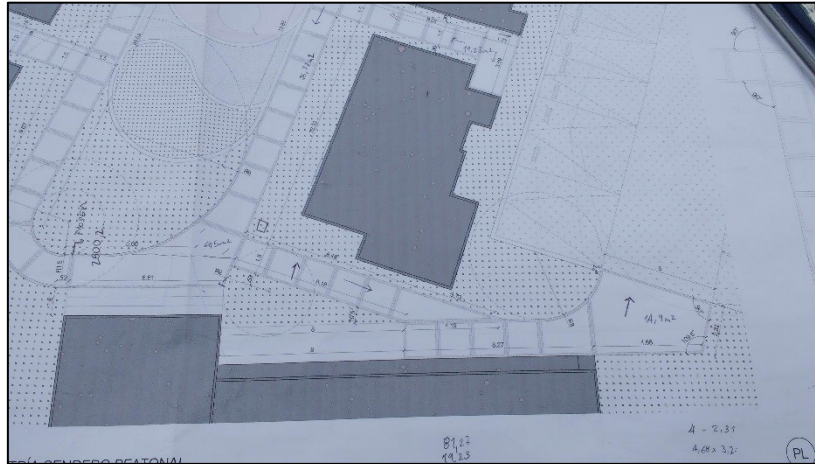
Image 16. Concrete test. Own development

6.2 Control of the work personnel



Image 17. Personal control. Source: own development

6.3 Preparation of calculation reports and amounts of work



6.4 Preparation of monthly work reports



Image 19. Preparation of work reports. Source: Own development



Image 20. Preparation of work reports. Source: Own development

6.5 Participant of work committees



Image 21. Work committee. Source: (Gobernación de Santander, 2019)

opportunity to increase their experience in the field of engineering and contributing to a prosperous and hard-working country.

7. BIBLIOGRAPHIC REFERENCES

- Ali, M. M., & Al-Kodmany, K. (2012). Tall Buildings and Urban Habitat of the 21st Century: A Global Perspective. *Buildings*, 2(4), 384–423. <https://doi.org/10.3390/buildings2040384>
- Chan, S. L., & Leung, N. N. (2004). Prototype web-based construction project management system. *Journal of Construction Engineering and Management*, 130(6), 935–943. [https://doi.org/10.1061/\(ASCE\)0733-9364\(2004\)130:6\(935\)](https://doi.org/10.1061/(ASCE)0733-9364(2004)130:6(935))
- Council on Tall Buildings and Urban Habitat. (1995) *Architecture of Tall Buildings*, McGraw Hill, U.S.A. 408.
- ICONTEC. (2015). *Norma Iso9001_2015. SISTEMAS DE GESTIÓN DE LA CALIDAD. REQUISITOS*. Recovered from <http://www.minvivienda.gov.co/Documents>
- Marques, B., Sousa-pinto, B., & Silva-costa, T. (2017). *IT Management of Building Materials' Planning and Control Processes Using Web-Based Technologies*. (April). <https://doi.org/10.1007/978-3-319-56538-5>
- Ministerio de educación nacional, C. (2008). *Manual de procedimientos interventoria y supervisión de contratos*. 24.
- Moisés Ortiz. (2011). Acerca - Excel Total. *Moisés Ortiz*, p. 3. Retrieved from <https://exceltotal.com/acerca/>
- Ozorhon, B., Karatas, C. G., & Demirkesen, S. (2014). A Web-based Database System for Managing Construction Project Knowledge. *Procedia - Social and Behavioral Sciences*, 119(1995), 377–386. <https://doi.org/10.1016/j.sbspro.2014.03.043>
- Pmbok Guide. (2000). *A Guide to the Project Knowledge Body of Management (PMBOK®)*

Guide) Third edition (Vol. 3). <https://doi.org/10.1093/ajcp/69.5.475>

Sánchez Henao, J. C. (2010). Interventoría de proyectos y obras. In *International Journal of Man-Machine Studies* (Vol. 8). [https://doi.org/10.1016/S0020-7373\(76\)80001-6](https://doi.org/10.1016/S0020-7373(76)80001-6)

Sanchez, J. C. N. de C. (2010). *INTERVENTORÍA DE PROYECTOS Y OBRAS*. Retrieved from http://www.ghbook.ir/index.php?name=&option=com_dbook&task=readonline&book_id=13650&page=73&chkhask=ED9C9491B4&Itemid=218&lang=fa&tmpl=component

Sarmiento, D. A., Sosa, J. M., Sanchez, G. A., & Angarita, G. (2018). *Seguimiento y control para la obra de infraestructura vial bajo la metodología PMI en el municipio de Madrid Cundinamarca*. (September), 160–164.

Scott, D., Cheong, M., & Li, H. (2012). Web-based Construction Information Management System. *Construction Economics and Building*, 3(1), 43–52. <https://doi.org/10.5130/ajceb.v3i1.2910>

Urdaneta, H. G., & Pontificia Universidad Javeriana (Bogotá). (1998). Interventoría de la obra pública. Santafé de Bogotá: Centro Editorial Javeriano, CEJA.

The Construction Industry. (1996). MODEL FOR PARTNERING EXCELLENCE. *Model for Partnering Excellence*, (November).

Sharpe, R (1995). IT in the Construction Engineering Future Directions, IE Australia Forum. Sydney 21 February and Melbourne 22 February 1995

Zhu, Yimin (1999). Web-based Construction Document Processing through a Malleable Frame. Ph.D. thesis, University of Florida. UMI, Ann Arbor, USA