



## Construction management analysis of time management in residential house construction of samarinda

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### ABSTRACT

The construction services industry in Indonesia is expanding rapidly, necessitating efficient project management to maintain competitiveness. This study analyzes time management in residential construction in Samarinda, using the Critical Path Method (CPM) and Microsoft Project software. The research aims to identify deficiencies in current practices to enhance project efficiency. A quantitative approach was adopted, involving literature review, data collection through field surveys and interviews, and data analysis. Findings reveal that the total construction period is 93 days, with a project duration of 4,900 hours. Weather conditions were a significant factor causing incomplete tasks. Cost analysis indicates total expenses of Rp201,290,412, emphasizing the importance of precise cost management alongside time management. The study concludes that effective use of CPM and Microsoft Project can optimize scheduling, resource allocation, and overall project management. Recommendations include regular critical path reviews and enhanced team communication to mitigate delays and ensure timely project completion.

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## INTRODUCTION

The construction services industry in Indonesia has been growing, as indicated by the increasing number of construction projects. The rapid pace of these projects makes it challenging for construction service providers to maintain their competitive edge by managing projects with a more effective and efficient management system. (Matahelumual, Jamlay, & Titaley, 2024). A project is an effort or activity planned to achieve important goals, objectives, and expectations using the available budget and resources, and must be completed within a specified timeframe. (Nurhayati, 2010). For a project to run smoothly according to plan, it requires time management that will oversee the project from start to finish. The larger the scale of the project, the longer the construction period needed and the more varied the risks involved. The timeline for completing a

project must be carefully calculated and considered. Good planning is the key to meeting demands. Time management becomes a top priority to ensure the construction project is carried out effectively and efficiently. In Gerung's (2016) research, planning, organizing, and monitoring the project schedule are necessary processes to ensure the project is completed on time. Time management is one of the essential processes to ensure that the project is completed on time and with optimal results. Thus, the results of the work will be maximized with the availability of human resources that are appropriate for the field. Effective and efficient planning for service providers in managing project time becomes a benchmark in the completion of a construction project. In situations where project delays often become a source of disputes among the various parties involved in a construction project (Solis, Corona-Suarez, & Garcia, 2015). The completion of construction projects should prioritize not only time but also quality and the available budget. Project delays must be avoided, as they are crucial for successful construction management, where projects need to be completed on time, within budget, and according to the planned schedule, while meeting required standards of quality, safety, and environmental considerations. (El-Karim, El-Nawawy, & Abdel-Alim, 2017). The importance of precise time management is to prevent cost overruns.

Therefore, a management that can integrate all available resources is needed. Time management is crucial for setting priorities and enhancing project effectiveness and efficiency to maximize the benefits of available resources. (Gerung, Dundu, & Mangare, 2016). In addition to managing time and costs, control also plays a crucial role in minimizing deviations that may occur during the project in accordance with the plan. Time management analysis strongly supports completing tasks according to the plan and achieving optimal results. (Kiswati & Chasanah, 2019). By implementing good time management, the benefits of construction implementation can be carried out as planned.

In addition to effective time management, it's crucial to ensure that the project is executed well according to its plan. In construction projects, cost, time, and quality are significant concerns and objectives that must be achieved. Costs and time are interrelated; when they exceed the planned parameters, costs typically increase. Throughout the project execution, attention is directed towards ensuring that time and costs align with the plan while maintaining quality (Rahmanto & Janizar, 2022). Currently, there are construction projects experiencing low performance in timely completion, prompting the need for time management analysis in home construction by contracting companies. This analysis aims to identify existing deficiencies and weaknesses to provide input for contractors to enhance time management in construction.

Considering the constraints faced by companies in effectively managing time, it's important to identify and analyze the obstacles hindering this process. This analysis will provide input for contractors to enhance the implementation of time management and avoid delays resulting from errors, which can have a negative impact on the company's financial flow and construction funding. (Kiswati & Chasanah, 2019) In their research, they emphasize that in construction projects involving numerous interrelated activities, effective time management aids in achieving outcomes aligned with plans. In connection with these matters, the implementation of project time management receives special attention. Therefore, the author is particularly interested in analyzing time management in the implementation of residential construction in Bukuan, Samarinda City.

Since prehistoric times, houses have become part of human life, starting with simple forms such as caves used by ancestors as dwellings (Sunarmi, 2013). A house is a building designed to provide a decent life and comfort for its occupants (Widyarthara, Hamka, & Winarni, 2020). There are many factors that influence a person in determining a home, which include price, building area, home design, distance to work and school, and availability of security facilities (Supriyono & Sari, 2015). The arrangement of space in a residential house needs to be adjusted to the number and

activities of its residents as well as individual characteristics that will affect the selection of colors, decorations, and themes of the house (Kemalawati, 2021).

Construction management can be interpreted as an organization that is multi-disciplinary (Tama, Anggraini, & Tutuko, 2020). Construction management is aimed at organizing development in such a way that the results obtained are more optimal (Wibowo & Rozy, 2020). Construction management includes planning, organizing, implementing and supervising (Tama, Anggraini, & Tutuko, 2020) Therefore, to achieve the desired development, it must pay attention to building quality, cost and time and always supervise. Construction management consists of planning, organizing, implementing and supervising. In making a development requires the name of a project management.

Project management is a strategy that aims to achieve efficiency and effectiveness in company operations with planning that aims to increase profits (Darmawan & Ratnasari, 2020). Project management involves a data processing process that includes planning, organizing, and managing resources considering the time factor (Gheffira, Inayah, Teguh, & Oktaviany, 2019). Project management is used for a wide variety of projects, generally to complete large-scale and complex projects to achieve the final result with limited time and funding constraints. In a project also has risks, therefore in a project must make risk management

Risk management involves systematic methods of planning, identifying, analyzing, responding and monitoring to project risks. The more well-managed, the less risk will provide benefits in terms of cost and execution of project development. (Moi & Neny, 2021). According to Fatkhullah, et al. (2022) Risks in project management are grouped into two categories, namely external risks related to environmental factors and internal risks related to the individual or organization itself. The goal of risk management planning and project management is to optimize time and results.

Time management starts with the idea that time is money (Vinahapsari & Rosita, 2020). Time management aims to increase productivity by managing outputs and inputs. Aspects include establishing a project schedule, monitoring progress, and producing project reports and comparisons with the established schedule (Pasaribu, Tarigan, & Harahap, 2021). Time management is an important skill in the world of work. Workers who can manage their time well will have a positive impact on themselves and the company they work for because they will produce work that is not delayed.

Critical Path Method (CPM) is a project planning method that uses a network model to describe the sequence of activities from start to finish in a project (Iluk, Ridwan, & Winarto, 2020). The CPM method can be used when the duration of the work is known, and the calculation of duration in CPM is done using a single duration estimate. (Utomo, Hendriyani, & Aida, 2020).

The focus on Adaptive Project Control Theory recognizes that change is common and develops management systems responsive to change, emphasizing schedule flexibility and rapid adaption. The implementation of time management in construction projects in Indonesia has proven successful with several positive outcomes. Firstly, effective time management, including structured project schedule organization and monitoring, enhances the likelihood of on-time project completion. Secondly, efforts to minimize delays and control costs have succeeded through good time management practices, ensuring projects stay within budget and finish on schedule. Thirdly, continuous analysis and evaluation of barriers and challenges in construction projects provide recommendations for improving future project implementation efficiency.

The specific objectives of this research are to analyze time management in residential construction projects in Bukuan, Samarinda City, identify deficiencies in current practices, and provide input for contractors to enhance their time management and avoid delays. The results will be implemented by developing guidelines, conducting workshops, and testing the new strategies in real projects in Bukuan to observe their effectiveness. Bukuan was chosen due to its rapid

development, unique challenges, and availability of data from local contractors. This study builds on previous research by focusing on a specific location and type of project, offering practical, localized insights and direct application of findings to improve time management practices in the Indonesian construction industry.

## RESEARCH METHOD

The research used is quantitative type research, using systematic, organized, and structured techniques from the start. Basically, everything that is determined by the researcher to be studied to obtain information. (Kurnaini, Lalan, & Adli, 2022). The method applied is CPM (Critical Path Method) is a type of research used to analyze the design of the sequence of project activities. CPM is a project management model that focuses more on cost analysis as the main priority being analyzed, and can have a significant impact on the target project completion time. (Daffa & Sukanta, 2022).

Each activity can be completed faster than the time normally required, to avoid some costs, thus if the project completion time is not satisfactory certain activities can be taken shortcuts so that the project can be completed faster. (Septiawan, 2020). This research consists of several stages, namely: (1) The beginning of the research, which is an initial stage of recognizing problems related to an object, and a situation. (2) Literature review, where this research is carried out to become a theoretical basis or as a reference for solving problems scientifically. And also, to complete the research work, literature research and planning for research materials, journals and previous papers are carried out. (3) Data collection, in this process data is collected in relation to the ongoing survey. Original data, such as the number of jobs and also data derived from other sources. (4) Processing and analyzing data, in this step the data is processed and analyzed. The result is the draft budget and project schedule using Microsoft Project, and the last step is the finalization of the project schedule. (5) Conclusions and suggestions, where after being analyzed, the next step is to draw conclusions that provide important information about the research objectives, provide recommendations for research progress, and provide a source of evaluation for future research. (Junaidi, Sari, & Ardian, 2023).

### a. Data Collection Techniques

This technique is part of the research process where the collected data is organized and processed to provide answers to research questions. Data analysis is the process of managing and processing data which is divided into two types of data, namely primary data taken by direct field monitoring and secondary data collected by collecting data from house construction projects including project drawings, and cost budget plans. Secondary data is collected through interviews with resource persons regarding two forms of activities by knowing the duration of the implementation of the house construction project, recording and analyzing various conditions related to the project implementation stage. (Putri, Ermawati, & Anjelina, 2023).

### b. Research Flow

The research began by conducting a field survey, which involved collecting information directly from the project site. This step aims to obtain empirical data and understand the real conditions on the ground that may affect the project. Activities carried out include direct observation, interviews with relevant parties, taking photos or videos, and measuring relevant physical parameters. After that, a literature study was conducted to understand the theories and previous research related to the project topic. This literature study includes reading books, scientific journals, articles, and research reports, identifying methodologies used in similar studies, and collecting secondary data that supports the research. The next stage is data collection, where the information required for the project analysis is collected. This data can be primary data from

field surveys and secondary data from literature studies. Data collection can also be done through questionnaires or surveys to relevant respondents as well as previous project documentation. After the data is collected, project data processing is carried out using the CPM (*Critical Path Method*) method. This step includes identifying all activities required to complete the project, determining the sequence and dependency between activities, calculating the duration of each activity, and preparing a network diagram that shows the sequence and interrelationship of activities. Furthermore, the critical path is identified to determine the project completion time and analyze activities that have *float* or *slack*. In the discussion stage, the results of data processing are analyzed and interpreted. This analysis includes evaluation of the critical path and its implications for project management, identification of risks and barriers, and discussion of important findings from field data and literature studies. The study concludes by drawing conclusions and recommendations. The conclusions summarize the key findings, while the suggestions provide practical recommendations for future project management improvements and enhancements. In addition, further research is suggested to deepen or extend the existing findings. The final report is organized systematically and comprehensively to present all stages of this research.



Figure 1. Research flow chart

## RESULTS AND DISCUSSIONS

Scheduling means figuring out the order which tasks or operations should happen in a project and organizing when they'll happen. Using computer tools and software has its perks because they can handle large amounts of data and catch mistakes made during data entry, even for small details. Plus, planned scheduling tends to be quicker and more detailed. Project scheduling with computers can speed up processes and be advantageous. In this section where we discuss the results, we've analyzed the estimated time and cost for building house in Samarinda. We've tackled various issues faced during this project. To track progress, we need data like budget plans and schedules. We'll analyzed the project's progress using the Critical Path Method (CPM) with the help of Microsoft Project software to speed up work and make the project more efficient. Based on our evaluation, we'll have data on estimated work times, costs and stages of completion from start to finish.

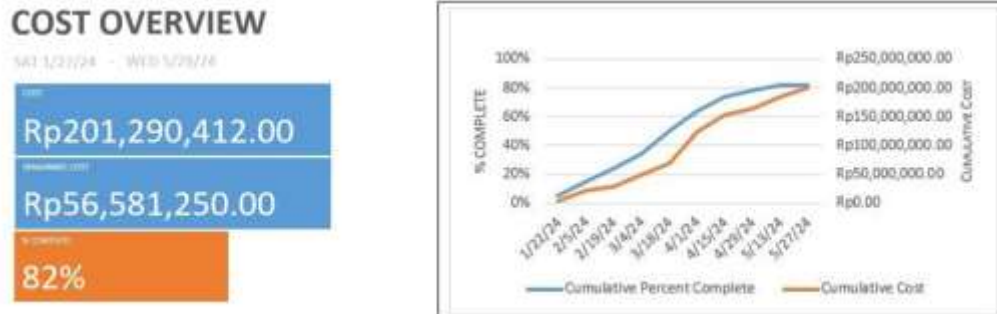


Figure 2. cost overview

A cost overview gives you a big-picture look at all the expenses tied to a project, product, service, or business activity. It covers every cost element related to starting, running, and completing a task or project. This includes direct costs, indirect costs, fixed costs, variable costs, and projected costs. In this study, the cost review focuses on direct costs like raw materials and labor wages. Additionally, it includes indirect costs such as overhead expenses and administrative costs. In Figure 2, you can see that the total cost incurred from the preparation stage to finishing is Rp201,290,412 with a completion percentage of 82%. Moreover, the cost of building the house, as shown in the line diagram, increases day by day due to the increasing amount of materials needed to complete the house construction project in Samarinda.

Name	Actual Cost	Remaining Cost	Baseline Cost	Cost	Cost Variance
PREPARATION	Rp11,925,000.00	Rp0.00	Rp0.00	Rp11,925,000.00	Rp11,925,000.00
LAND WORK	Rp14,715,000.00	Rp0.00	Rp0.00	Rp14,715,000.00	Rp14,715,000.00
FOUNDATION WORK	Rp16,573,700.00	Rp0.00	Rp0.00	Rp16,573,700.00	Rp16,573,700.00
WALL CONSTRUCTION	Rp27,124,256.00	Rp0.00	Rp0.00	Rp27,124,256.00	Rp27,124,256.00
ROOF INSTALLATION	Rp8,125,000.00	Rp0.00	Rp0.00	Rp8,125,000.00	Rp8,125,000.00
TOILET CONSTRUCTION	Rp19,663,000.00	Rp21,480,000.00	Rp0.00	Rp41,143,000.00	Rp41,143,000.00
CEILING INSTALLATION	Rp6,979,750.00	Rp2,126,250.00	Rp0.00	Rp9,106,000.00	Rp9,106,000.00
DOOR INSTALLATION AND VARIATIONS	Rp21,432,750.00	Rp2,598,750.00	Rp0.00	Rp24,031,500.00	Rp24,031,500.00
FLOOR INSTALLATION	Rp6,259,500.00	Rp4,725,000.00	Rp0.00	Rp10,984,500.00	Rp10,984,500.00
PAINTING	Rp5,453,056.00	Rp4,725,000.00	Rp0.00	Rp10,178,056.00	Rp10,178,056.00
INTERIOR INSTALLATION	Rp6,458,150.00	Rp2,126,250.00	Rp0.00	Rp8,584,400.00	Rp8,584,400.00
FINISHING	Rp0.00	Rp18,800,000.00	Rp0.00	Rp18,800,000.00	Rp18,800,000.00

Figure 1. cost structure table

Entering the cost structure table refers to breaking down or representing the various expenses incurred by a business or organization in its operations. This table typically details various types of costs, much like the cost overview, including fixed costs, variable costs, direct costs, and indirect costs. The cost structure table provides valuable insights into a business's

financial health and assists in decision-making based on information related to pricing strategies, cost-saving measures, and resource allocation. It's an important tool for financial analysis and planning. In this cost structure table, several types of expenses are outlined, including actual cost, remaining cost, baseline cost, the cost itself, and cost variance.

Actual cost refers to the actual expenses incurred or happened during an activity or project. In the context of project management or manufacturing, actual cost refers to the actual expenses incurred during the project execution or production of goods. It includes costs that have been paid and officially recorded in the company or organizational system. In Figure 1.2, after actual cost, there is remaining cost, which is the estimated cost needed to complete a project or activity after a certain stage of the project has progressed. It's the amount of money estimated to be spent in the future to complete the remaining unfinished work. In project management, remaining cost is usually calculated by subtracting the total actual costs incurred to date from the estimated total project cost, providing an estimate of the cost needed to complete the remaining work. Next, there is baseline cost, which is the initial cost estimate or budget set as a reference point to compare actual costs in a project or activity. Baseline cost is usually set at the beginning of project planning as a basis for measuring project performance and evaluating whether the project is proceeding according to its initial plan. From Figure 3, we can see that the baseline cost from the preparation stage to finishing is Rp0. Following baseline cost is the cost itself, which is the amount of money spent or expected to be spent to produce a specific good or service. It includes all expenses directly or indirectly related to the production or procurement of goods or services. Lastly, there is cost variance, which is the difference between the actual costs incurred in a period and the expected or budgeted costs for that period. Cost variance is used by management to assess the performance and operational effectiveness of an organization or project. Analyzing cost variance is very helpful in identifying areas where costs may exceed or fall short of initial estimates, enabling a company or organization to take corrective action or policy adjustments as needed.

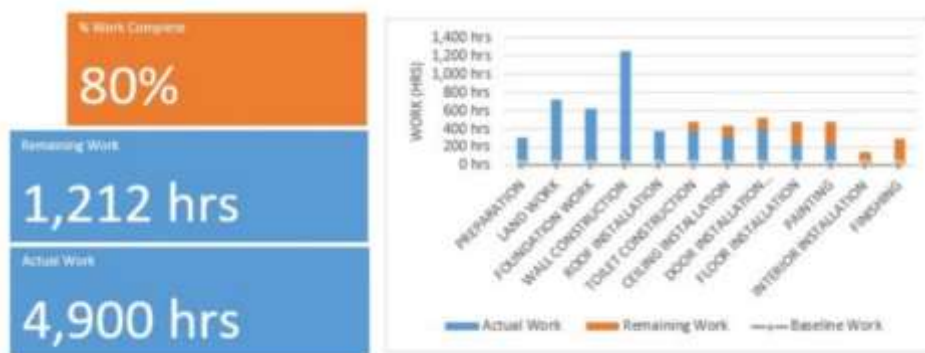


Figure 2. Work Overview

A work overview, also known as a job summary, gives a detailed rundown of tasks, responsibilities, objectives, or goals tied to a specific job or project. It gives a quick understanding of what's needed for the job, like expected outcomes, timelines, and what's expected from you. In project management, it's like a job description, a way to evaluate how well you're doing, or a heads-up to your team about what tasks are coming up. In Figure 4, it shows the total time it'll take for the house construction project in this study, which is 4,900 hours, with 1,212 hours still left to finish. Then, there's a bar chart showing how much time is spent from the beginning to the end of the project. Looking at the table, you can see that building the walls takes the longest time, totaling 1,200 hours. That's because building walls in a house needs careful planning, like measuring the land, setting up the foundation, and making sure everything is safe and up to standards.

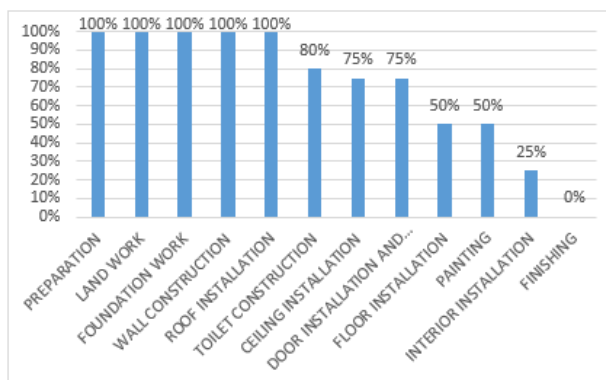


Figure 3. Project Overview

A project overview is like a snapshot of a particular project that's in the pipeline. It gives you the basics: what the project aims to achieve, what it involves, what resources will be used, when it needs to be done, and sometimes even a rough outline of how we plan to get there. Usually, it lays out the main goals or expected outcomes, spells out the project's boundaries, gives an idea of the major stages involved and how long each will take, identifies the team members, budget, equipment, and materials needed, and describes what the end result of the project should look like. Looking at Figure 5, we can see there are 4 work stages that are at 100% completion, meaning they're done and dusted. These include prep work, land clearing, laying the foundation, building the walls, and putting on the roof. But there are other stages, like putting in toilets, installing ceilings and doors, laying floors, painting, interior work, and finishing touches, that haven't hit the 100% mark yet. This could be due to factors like extreme weather—heavy rain, storms, or really hot temperatures—which can sometimes temporarily stop construction work.

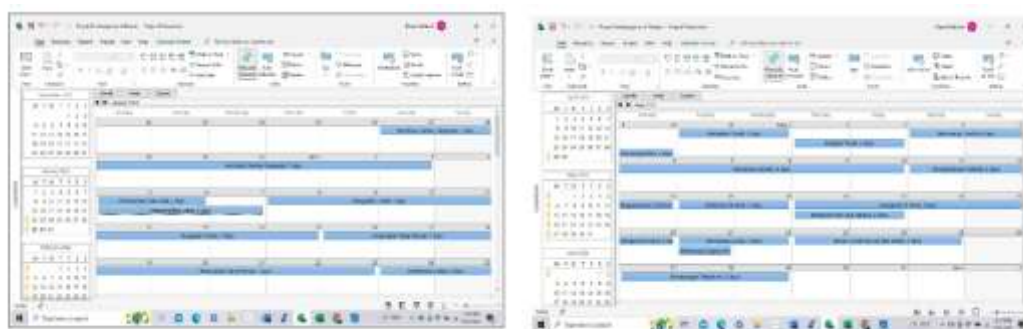


Figure 4. Project Schedule

The project schedule, often referred to as the project timeline, is a tool used to plan, organize, and manage the time needed to complete various tasks within a project. The main elements of a project schedule include a clear and specific list of tasks and activities, the duration needed to complete each task in daily, weekly, yearly, or monthly formats adjusted to the project's scale, task sequencing from start to finish, identifying key milestones in the project to determine if they've been achieved or not, other required resources such as software, hardware, or materials, allocating start and finish times for each task, and continuously monitoring project progress and making schedule adjustments as needed.

In Figure 6, the house construction project in this study starts with preparation, which includes designing the house plan from January 27th to February 3rd. Then, it moves on to layout planning from February 5th to February 6th, followed by final preparation, which is land clearing

for 3 days starting on February 5th, the same day as layout planning, until February 7th. The next phase is land work, starting with soil excavation from February 8th to February 15th, followed by pile driving for 7 days from February 16th to February 23rd. Next is land filling from February 24th to February 27th, and the final land work phase is remeasurement on the following day, February 28th.

Moving on to the next stage, foundation work begins with steel assembly and layout from February 29th to March 2nd, followed by stone installation from March 4th to March 8th. Next is foundation casting from March 9th to March 12th, with layout creation on the following day, March 13th to March 15th. The house construction phase in this study involves wall construction, which includes framing, wall building, and water installation starting on the same date, March 16th, with varying completion estimates: framing takes 7 days, wall building takes 14 days, and water and electricity installation takes 5 days. Next is roof installation, which takes 8 days, with light steel roof frame installation for 4 days and spandex roof installation for another 4 days. The toilet construction phase comes after roof installation, starting with septic tank installation for 3 days from April 6th to April 8th, followed by septic tank pipe installation and toilet fixture installation until April 10th. Then, drain installation, ceramic installation, and faucet installation take place for 2 days until April 11th. After roof installation and toilet work, the next phase is ceiling installation, starting with hollow ceiling frame installation for 3 days until April 13th, followed by electrical installation and gypsum installation for 6 days from April 15th to April 20th. Once ceiling installation is complete, door and fixture installation begin, with an estimated completion time of 7 days from April 22nd to April 29th. Next is floor installation, starting with leveling the ground, which takes only 2 days, followed by ground covering for 2 days, and finally, granite installation for 8 days from May 4th to May 10th.

Entering the last three stages of this house construction, painting, interior work, and finishing. Before painting, rough surfaces of the walls are sanded down. This stage is estimated to take 2 days from May 11th to May 13th, followed by wall covering and painting for 6 days. Painting doors and windows is the final step of this painting phase with an estimated completion time of 2 days. After that, interior work begins with light and door handle installation, estimated to take 3 days. The final stage is finishing, which involves cleaning up paint and cement residue and installing the water tank, estimated to take 6 days.

## CONCLUSION

Based on the data we've processed and analyzed, along with the discussions we've had, here are the key takeaways: The total time it takes to build houses in Samarinda is 93 days (excluding holidays). The construction process takes about 4,900 hours in total. Some parts of the construction couldn't be completed fully due to weather conditions.

Considering our findings, here are some recommendations: Use Microsoft Project to keep track of the project schedule in real-time and optimize it. Make sure your project team is trained to make the most of this software, including managing critical paths and analyzing scenarios. Ensure effective communication among team members with regular meetings and by using collaboration features in Microsoft Project. This will help keep everyone updated on the project's status and make quick adjustments if needed. Regularly review critical paths using Microsoft Project to spot potential delays. Take immediate action to fix any issues and ensure the project stays on track and within budget.

This project was all about the storage and there were a lot of materials that were done, very well protected because all materials had been covered in special tar-polins. This allow to keep the materials healthy, and avoid damaged before construction is going on. Besides that, personnel involved in this project are provided with full personal protective equipment including helmets, gloves, safety shoes and any other safety device. This is done in an effort to ensure that workers are safe and healthy when they are working so that there is minimal disruption during the execution

of work projects due to accidents. This research does not develop new theories. It uses existing project management techniques such as CPM and Microsoft project to analyze time management in home construction in Indonesia. The aim is to identify problems, then recommend ways to help improve time management and avoid delays.

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