Jurnal Teknik Indonesia
Volume 5 Nomor 4, October 2026
pp. 877-886
DOI: https://doi.org/10.58860/jti.v5i4.1005

# Cost and Time Analysis of Stone Masonry Acceleration using The Fast-Track Method on The Kedunglarangan River Improvement Project, Pasuruan Regency

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**Keywords:**
Fast-Track Method; Project Acceleration; Scheduling; Stone Masonry; Microsoft Project; River Improvement.

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**Abstract**

Delays in river embankment construction can hinder the timely completion of infrastructure intended to mitigate flooding and slope failure. This study aimed to assess schedule acceleration using the fast-track method for stone masonry work on the Kedunglarangan River Improvement Project in Pasuruan Regency, Indonesia. The analysis used project schedules, work breakdown structures, activity quantities, and field productivity data to identify remaining activities and establish scheduling relationships in Microsoft Project. Critical activities were rescheduled through overlapping execution, with selected finish-to-start (FS) relationships modified to start-to-start (SS) relationships using specified time lags. The project experienced an approximately 10% progress shortfall between Weeks 2 and 8, requiring adjustments to the remaining structural and masonry work. The accelerated schedule resulted in a total project duration of 82 days, compared with the original duration of 94 days, representing a reduction of 12 days, or approximately 12.77%. These findings indicated that overlapping critical activities could shorten the construction schedule while maintaining the necessary activity dependencies. However, quantified cost outcomes were not provided, preventing conclusions regarding potential cost savings. The study concluded that the fast-track method provided a viable scheduling alternative for this project, subject to verification of activity dependencies, resource availability, and construction feasibility prior to field implementation.

## INTRODUCTION

River embankments and retaining walls are among the flood-control and slope-protection structures implemented by water resources agencies in Indonesia, and stone masonry is one of the construction types used for such works (Suresh, 2024). In river improvement projects, construction is typically carried out within limited time windows because the structures are intended to reduce flood risk during the rainy season and to prevent slope failure caused by saturated soil. Delays during the structural and masonry stages can therefore postpone the completion of protection that the surrounding area depends on (Bhatnagar et al., 2026; Borah et al., 2023; Latifi et al., 2023; Zhu et al., 2026).

Project scheduling is a core function of project management because it defines the durations, sequences, and dependencies of activities that determine the planned completion date (Dipohusodo, 1996; Kerzner, 2022). Network-based techniques such as the critical path method (CPM) are used to identify the critical activities that govern the total project duration (Fadila et al., 2024).

When actual progress falls behind the baseline schedule, schedule compression can be applied to recover the lost time without changing the scope of work (Hou & Yang, 2026; Sadok et al., 2026; Salhab et al., 2024). Two commonly discussed techniques are crashing, which adds resources to critical activities, and fast tracking, which overlaps activities that were originally planned to run in sequence (Kerzner, 2022). Fast tracking has been applied to control construction time in Indonesian building projects (Hermawan & Yanthi, 2023; Tistogondo et al., 2023). In scheduling software, it is implemented by changing the logical relationship between critical activities, for example from finish-to-start (FS) to start-to-start (SS) with a specified lag (Alyami et al., 2025; Haque & Mathur, 2025; Saleh et al., 2024; Ubyani et al., 2023).

The benefit of fast tracking depends on whether activities can actually be overlapped. For example, an application to a building project in Denpasar reported that several critical activities could not be accelerated because they were already saturated and offered no feasible lag (Hermawan & Yanthi, 2023). Time and cost performance are also frequently evaluated together in Indonesian construction studies (Aris & Oetomo, 2022; Fairus & Wibowo, 2025; Prisma Adriansyah & Gita Prafitasiwi, 2023). In the literature reviewed for this study, applications of fast tracking to river embankment works with stone masonry were less documented than applications to building projects.

The Kedunglarangan River Improvement Project in Pasuruan Regency involves the construction of a 66 m stone masonry retaining wall for critical embankment protection and was executed as a self-managed project of the Brantas Water Resources Operation Unit. Between Weeks 2 and 8, progress lagged behind the plan by approximately 10%, leaving a limited remaining period for the structural and masonry works.

Accordingly, this study aims to assess schedule acceleration using the fast-track method for stone masonry work on the Kedunglarangan River Improvement Project. The study identifies the remaining critical activities, modifies selected FS relationships to SS relationships with specified lags in Microsoft Project, and compares the resulting duration with the original schedule. The analysis focuses on the schedule dimension; cost outcomes were not quantified.

## METHOD

This study employed an applied quantitative approach to analyze schedule acceleration using the fast-track method for stone masonry work on the Kedunglarangan River Improvement Project in Pasuruan Regency. Primary data were obtained through field observations of actual work progress and productivity, while secondary data were collected from project documents, including the work schedule, work breakdown

structure (WBS), work quantities, and progress reports. Because the analysis addresses scheduling, cost data were not analyzed.

Field observations were conducted to verify actual project conditions and work progress, while project documents were examined to obtain the planned schedule and activity quantities required for the scheduling analysis. The collected data were organized according to the project baseline and actual progress to identify the remaining activities after the delay was detected.

The analysis followed five stages: (1) identification of project activities and remaining work, (2) determination of activity relationships, (3) preparation of the normal schedule and identification of the critical path in Microsoft Project, (4) estimation of productivity and remaining durations from field implementation, and (5) schedule acceleration by modifying selected relationships between critical activities from finish-to-start (FS) to start-to-start (SS) with specified lag times. The accelerated duration was then compared with the normal duration to calculate the time reduction (Kerzner, 2022; Tistogondo et al., 2023). Cost performance, which is commonly assessed with the earned value method (Fairus & Wibowo, 2025; Prisma Adriansyah & Gita Prafitasiwi, 2023), was outside the scope of this analysis.

## RESULTS AND DISCUSSION

### Project Profile

The stone masonry construction project on the Kedunglarangan River, Pasuruan Regency, is a critical river embankment protection project aimed at mitigating flood risks during the rainy season and preventing slope failures caused by saturated soil conditions. The project profile is summarized as follows:

Project Name : Critical Embankment Protection of the Kedunglarangan River
Project Location : Dukuh Bekacak Village, Bangil District, Pasuruan Regency
Project Type : Self-Managed Project
Funding Source : DIPA of the Brantas Water Resources Operation Unit (OP SDA Brantas)
Project Start Date : March 25, 2026
Project Completion Date : July 11, 2026
Project Duration : 16 Weeks (94 Days)
Project Owner : OP SDA II, Brantas River Basin Organization (BBWS Brantas)
Project Designer : OP SDA II, BBWS Brantas
Project Supervisor : OP SDA II, BBWS Brantas
Contractor : OP SDA II, BBWS Brantas
Type of Work : Stone Masonry Construction
Retaining Wall Length : 66 m

### Work Items

The Kedunglarangan River stone masonry construction project consists of several major work packages, beginning with preparatory activities and ending with finishing works. These work packages include preparatory works, earthworks, dewatering works,

structural works, masonry works, piling works, and miscellaneous works. The complete list of work items is presented in Table 1.

**Table 1.** Work Items

| No | Work Description |
|---|---|
| I | PREPARATORY WORKS |
| II | EARTHWORKS |
| III | DEWATERING WORKS |
| IV | STRUCTURAL WORKS |
| V | MASONRY WORKS |
| VI | PILING WORKS |
| VII | MISCELLANEOUS WORKS |

Source: Project Data

**Work Breakdown Structure**

The Work Breakdown Structure (WBS) is a systematic approach used to divide the project into smaller and more manageable work components. This approach facilitates project planning, resource allocation, progress monitoring, and project control throughout the construction process (Dipohusodo, 1996). The Work Breakdown Structure for the Kedunglarangan River stone masonry construction project is presented in Table 2.

**Table 2.** Work Breakdown Structure

| No. | Work Description |
|---|---|
| **I. PREPARATORY WORKS** | |
| 1.1 | Surveying and Setting Out (Bowplank) |
| 1.2 | Site Clearing |
| 1.3 | Occupational Health and Safety (OHS) Implementation |
| 1.4 | Demolition of Existing Stone Masonry Using Equipment |
| 1.5 | Mobilization and Demobilization |
| **II. EARTHWORKS** | |
| 2.1 | Mechanical Excavation |
| 2.2 | Backfilling |
| 2.3 | Soil Compaction |
| 2.4 | Earth Filling |
| **III. DEWATERING WORKS** | |
| 3.1 | Sandbag Installation |
| 3.2 | Bamboo Sheet Installation |
| 3.3 | Sandbag Retaining Frame Installation |
| **IV. STRUCTURAL WORKS** | |
| 4.1 | Concrete Works |
| 4.2 | Reinforcement with Ø6 mm Plain Bars |
| 4.3 | Reinforcement with Ø8 mm Plain Bars |
| 4.4 | Reinforcement with Ø10 mm Plain Bars |
| 4.5 | Foundation and Tie Beam Formwork |
| 4.6 | Beam Formwork |
| 4.7 | Column Formwork |
| **V. MASONRY WORKS** | |
| 5.1 | Stone Masonry with Type M Mortar (fc' = 17.2 MPa) |
| 5.2 | Weep Hole Pipe Installation |
| 5.3 | 15 mm Thick Plastering (1 Cement : 3 Sand) |
| 5.4 | Surface Finishing (Skim Coat) |

5.5 Pointing Works
5.6 Rubber Joint Installation
**VI. PILING WORKS**
6.1 Drilling of Ø20 cm Strauss Pile
6.2 Supply of Bamboo Piles (Ø8–10 cm)
6.3 Installation of Bamboo Piles (Ø8–10 cm)
**VII. MISCELLANEOUS WORKS**
7.1 Drainage Inspection Chamber Construction
7.2 Supply and Installation of Ø50 cm Concrete Pipe
7.3 Supply and Installation of Ø30 cm Concrete Pipe

Source: Project Data

**Work Quantities**

Work quantities represent the total volume of each work item required for project execution. These quantities serve as the basis for estimating project costs, scheduling, and resource allocation. The work quantities for the Kedunglarangan River stone masonry construction project are presented in Table 3.

**Table 3.** Work Quantities

| No. | Work Description | Qty | Unit |
|---|---|---|---|
| **I. PREPARATORY WORKS** | | | |
| 1.1 | Surveying and Setting Out (Bowplank) | 63.00 | m |
| 1.2 | Site Clearing | 126.00 | m² |
| 1.3 | Occupational Health and Safety (OHS) Implementation | 1.00 | Ls |
| 1.4 | Demolition of Existing Stone Masonry Using Equipment | 16.65 | m³ |
| 1.5 | Mobilization and Demobilization | 1.00 | Ls |
| **II. EARTHWORKS** | | | |
| 2.1 | Mechanical Excavation | 159.54 | m³ |
| 2.2 | Backfilling | 125.88 | m³ |
| 2.3 | Soil Compaction | 391.20 | m³ |
| 2.4 | Earth Filling | 265.32 | m³ |
| **III. DEWATERING WORKS** | | | |
| 3.1 | Sandbag Installation | 296.00 | pcs |
| 3.2 | Bamboo Sheet Installation | 98.00 | m² |
| 3.3 | Sandbag Retaining Frame Installation | 24.70 | m³ |
| **IV. STRUCTURAL WORKS** | | | |
| 4.1 | Concrete Works | 81.78 | m³ |
| 4.2 | Reinforcement with Ø6 mm Plain Bars | 179.64 | kg |
| 4.3 | Reinforcement with Ø8 mm Plain Bars | 1,005.98 | kg |
| 4.4 | Reinforcement with Ø10 mm Plain Bars | 1,944.53 | kg |
| 4.5 | Foundation and Tie Beam Formwork | 90.84 | m² |
| 4.6 | Beam Formwork | 66.00 | m² |
| 4.7 | Column Formwork | 123.60 | m² |
| **V. MASONRY WORKS** | | | |
| 5.1 | Stone Masonry with Type M Mortar (fc' = 17.2 MPa) | 264.30 | m³ |
| 5.2 | Weep Hole Pipe Installation | 113.00 | m |
| 5.3 | 15 mm Thick Plastering (1 Cement : 3 Sand) | 42.18 | m² |
| 5.4 | Surface Finishing (Skim Coat) | 42.18 | m² |
| 5.5 | Pointing Works | 410.94 | m² |
| 5.6 | Rubber Joint Installation | 26.94 | m² |

| | | | |
|---|---|---|---|
| **VI. PILING WORKS** | | | |
| 6.1 | Drilling of Ø20 cm Strauss Pile | 65.60 | m |
| 6.2 | Supply of Bamboo Piles (Ø8–10 cm) | 38.00 | pcs |
| 6.3 | Installation of Bamboo Piles (Ø8–10 cm) | 76.00 | m |
| **VII. MISCELLANEOUS WORKS** | | | |
| 7.1 | Drainage Inspection Chamber Construction | 2.00 | unit |
| 7.2 | Supply and Installation of Ø50 cm Concrete Pipe | 1.00 | unit |
| 7.3 | Supply and Installation of Ø30 cm Concrete Pipe | 6.00 | unit |

Source: Project Data

**Fast Track Method Analysis**

The Fast Track method analysis was implemented by allowing several work activities to be carried out in parallel or through overlapping execution without having to wait for the preceding activities to be fully completed. The implementation of this method is expected to reduce the total project duration so that the project completion target can be achieved earlier than the original schedule.

**Normal Schedule Preparation**

The preparation of the normal schedule was used as the basis for this research. The normal schedule was developed by identifying all work items, determining the duration of each activity, and establishing the relationships among activities based on the project data.

**Project Activity Identification**

The activity identification focused on Week 2 to Week 8, as the project experienced delays during this period. From Week 2 to Week 8, the project progress lagged by approximately 10%. Based on the planned schedule, the project was expected to be completed in Week 16 (July), leaving less than 8 weeks for the remaining construction period. The remaining activities identified included structural works and masonry works. These remaining activities required rescheduling to ensure that the project completion could return to the planned schedule or comply with the project contract.

**Determining Activity Relationships**

After estimating the project duration, the next step was to determine the relationships among work activities based on the project time schedule. These relationships were established according to when each activity started and when it was required to be completed. The activity relationships were developed using Microsoft Project. The resulting activity relationships are presented in the project network.

**Normal Duration Scheduling and Critical Path Identification**

The project schedule was developed using Microsoft Project. From the completed network diagram, the normal project duration, representing the total duration required to complete the remaining activities, could be identified.

**Productivity and Project Duration Analysis**

After identifying the remaining project activities, the next step was to determine worker productivity and the duration of the remaining work based on the actual field

implementation. Consequently, the productivity level and the estimated project duration under normal working conditions were obtained.

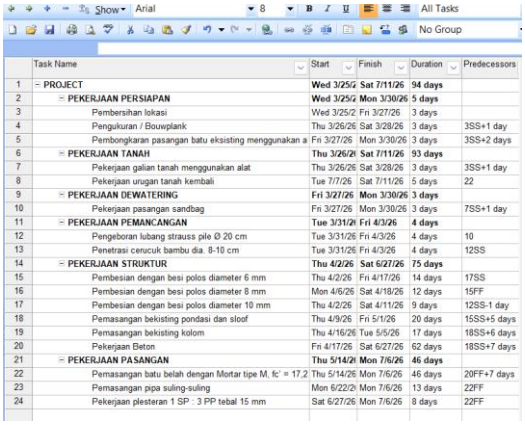
**Schedule Acceleration Using the Fast Track Method**

In implementing the Fast Track method to optimize project duration so that the project could be completed according to the original schedule, a revised schedule was prepared to obtain the optimum completion time from the normal schedule. This was carried out by applying the Fast Track method to activities located on the critical path. The main principle of the Fast Track method is to modify the relationships between critical activities from Finish-to-Start (FS) to Start-to-Start (SS) by introducing a specified lag time. Example: If an activity has a duration of 7 days, another activity may be performed simultaneously by allowing it to start 3 days after the first activity has begun. Once the first activity reaches its third day of execution, the second activity can commence.

**Table 4.** Work Quantities

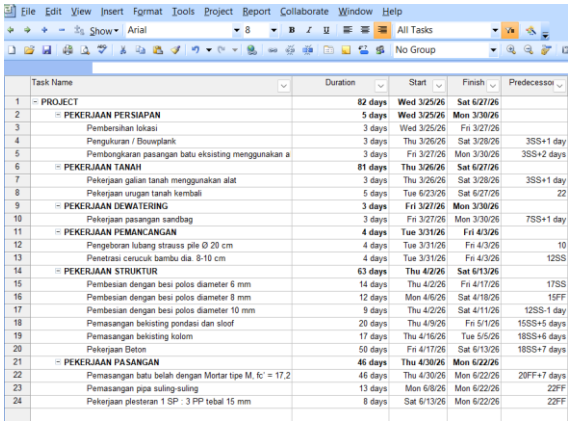
| No. | Work Description | Normal Predecessor | Fast Track Predecessor |
|---|---|---|---|
| A | Preparation Works | | |
| 1 | Site Cleaning | – | – |
| 2 | Surveying/Bouwplank | 3SS + 1 DAY | 3SS + 1 DAY |
| 3 | Demolition of Existing Stone Masonry Using Equipment | 3SS + 2 DAYS | 3SS + 2 DAYS |
| B | Earthworks | | |
| 4 | Mechanical Excavation | 3SS + 1 DAY | 3SS + 1 DAY |
| 5 | Backfilling | 22 | 22 |
| C | Dewatering Works | | |
| 6 | Sandbag Installation | 7SS + 1 DAY | 7SS + 1 DAY |
| D | Pile Works | | |
| 7 | Strauss Pile Drilling Ø20 cm | 10 | 10 |
| 8 | Bamboo Pile Driving Ø8–10 cm | 12SS | 12SS |
| E | Structural Works | | |
| 9 | Reinforcement Installation Using Ø6 mm Plain Bars | 17SS | 17SS |
| 10 | Reinforcement Installation Using Ø8 mm Plain Bars | 15FF | 15FF |
| 11 | Reinforcement Installation Using Ø10 mm Plain Bars | 12SS − 1 DAY | 12SS − 1 DAY |
| 12 | Foundation and Tie Beam Formwork Installation | 15SS + 5 DAYS | 15SS + 5 DAYS |
| 13 | Column Formwork Installation | 18SS + 6 DAYS | 18SS + 6 DAYS |
| 14 | Concrete Casting | 18SS + 7 DAYS | 18SS + 7 DAYS |
| F | Masonry Works | | |
| 15 | Stone Masonry Installation with Type-M Mortar (1 Cement : 4 Sand) | 20FF + 7 DAYS | 20FF + 7 DAYS |
| 16 | 15 mm Thick Plastering (1 Cement : 3 Sand) | 22FF | 22FF |
| 17 | Weep Hole Pipe Installation | 22FF | 22FF |

Source: Author's Analysis



| | Task Name | Start | Finish | Duration | Predecessors |
|---|---|---|---|---|---|
| 1 | PROJECT | Wed 3/25/2 | Sat 7/11/26 | 94 days | |
| 2 | PEKERJAAN PERSIAPAN | Wed 3/25/2 | Mon 3/30/26 | 5 days | |
| 3 | Pembersihan lokasi | Wed 3/25/2 | Fri 3/27/26 | 3 days | |
| 4 | Pengukuran / Bouvplank | Thu 3/26/26 | Sat 3/28/26 | 3 days | 3SS+1 day |
| 5 | Pembongkaran pasangan batu eksisting menggunakan a | Fri 3/27/26 | Mon 3/30/26 | 3 days | 3SS+2 days |
| 6 | PEKERJAAN TANAH | Thu 3/26/26 | Sat 7/11/26 | 93 days | |
| 7 | Pekerjaan galian tanah menggunakan alat | Thu 3/26/26 | Sat 3/28/26 | 3 days | 3SS+1 day |
| 8 | Pekerjaan urugan tanah kembali | Tue 7/7/26 | Sat 7/11/26 | 5 days | 22 |
| 9 | PEKERJAAN DEWATERING | Fri 3/27/26 | Mon 3/30/26 | 3 days | |
| 10 | Pekerjaan pasangan sandbag | Fri 3/27/26 | Mon 3/30/26 | 3 days | 7SS+1 day |
| 11 | PEKERJAAN PEMANCANGAN | Tue 3/31/26 | Fri 4/3/26 | 4 days | |
| 12 | Pengeboran lubang strauss pile Ø 20 cm | Tue 3/31/26 | Fri 4/3/26 | 4 days | 10 |
| 13 | Penetrasi cerucuk bambu dia. 8-10 cm | Tue 3/31/26 | Fri 4/3/26 | 4 days | 12SS |
| 14 | PEKERJAAN STRUKTUR | Thu 4/2/26 | Sat 6/27/26 | 75 days | |
| 15 | Pembesian dengan besi polos diameter 6 mm | Thu 4/2/26 | Fri 4/17/26 | 14 days | 17SS |
| 16 | Pembesian dengan besi polos diameter 8 mm | Mon 4/6/26 | Sat 4/18/26 | 12 days | 15FF |
| 17 | Pembesian dengan besi polos diameter 10 mm | Thu 4/2/26 | Sat 4/11/26 | 9 days | 12SS-1 day |
| 18 | Pemasangan bekisting pondasi dan sloof | Thu 4/9/26 | Fri 5/1/26 | 20 days | 15SS+5 days |
| 19 | Pemasangan bekisting kolom | Thu 4/16/26 | Tue 5/5/26 | 17 days | 18SS+6 days |
| 20 | Pekerjaan Beton | Fri 4/17/26 | Sat 6/27/26 | 62 days | 18SS+7 days |
| 21 | PEKERJAAN PASANGAN | Thu 5/14/26 | Mon 7/6/26 | 46 days | |
| 22 | Pemasangan batu belah dengan Mortar tipe M, fc' = 17,2 | Thu 5/14/26 | Mon 7/6/26 | 46 days | 20FF+7 days |
| 23 | Pemasangan pipa suling-suling | Mon 6/22/26 | Mon 7/6/26 | 13 days | 22FF |
| 24 | Pekerjaan plesteran 1 SP : 3 PP tebal 15 mm | Sat 6/27/26 | Mon 7/6/26 | 8 days | 22FF |

**Figure 1.** Normal Project Schedule in Microsoft Project



| | Task Name | Duration | Start | Finish | Predecessor |
|---|---|---|---|---|---|
| 1 | PROJECT | 82 days | Wed 3/25/26 | Sat 6/27/26 | |
| 2 | PEKERJAAN PERSIAPAN | 5 days | Wed 3/25/26 | Mon 3/30/26 | |
| 3 | Pembersihan lokasi | 3 days | Wed 3/25/26 | Fri 3/27/26 | |
| 4 | Pengukuran / Bouvplank | 3 days | Thu 3/26/26 | Sat 3/28/26 | 3SS+1 day |
| 5 | Pembongkaran pasangan batu eksisting menggunakan a | 3 days | Fri 3/27/26 | Mon 3/30/26 | 3SS+2 days |
| 6 | PEKERJAAN TANAH | 81 days | Thu 3/26/26 | Sat 6/27/26 | |
| 7 | Pekerjaan galian tanah menggunakan alat | 3 days | Thu 3/26/26 | Sat 3/28/26 | 3SS+1 day |
| 8 | Pekerjaan urugan tanah kembali | 5 days | Tue 6/23/26 | Sat 6/27/26 | 22 |
| 9 | PEKERJAAN DEWATERING | 3 days | Fri 3/27/26 | Mon 3/30/26 | |
| 10 | Pekerjaan pasangan sandbag | 3 days | Fri 3/27/26 | Mon 3/30/26 | 7SS+1 day |
| 11 | PEKERJAAN PEMANCANGAN | 4 days | Tue 3/31/26 | Fri 4/3/26 | |
| 12 | Pengeboran lubang strauss pile Ø 20 cm | 4 days | Tue 3/31/26 | Fri 4/3/26 | 10 |
| 13 | Penetrasi cerucuk bambu dia. 8-10 cm | 4 days | Tue 3/31/26 | Fri 4/3/26 | 12SS |
| 14 | PEKERJAAN STRUKTUR | 63 days | Thu 4/2/26 | Sat 6/13/26 | |
| 15 | Pembesian dengan besi polos diameter 6 mm | 14 days | Thu 4/2/26 | Fri 4/17/26 | 17SS |
| 16 | Pembesian dengan besi polos diameter 8 mm | 12 days | Mon 4/6/26 | Sat 4/18/26 | 15FF |
| 17 | Pembesian dengan besi polos diameter 10 mm | 9 days | Thu 4/2/26 | Sat 4/11/26 | 12SS-1 day |
| 18 | Pemasangan bekisting pondasi dan sloof | 20 days | Thu 4/9/26 | Fri 5/1/26 | 15SS+5 days |
| 19 | Pemasangan bekisting kolom | 17 days | Thu 4/16/26 | Tue 5/5/26 | 18SS+6 days |
| 20 | Pekerjaan Beton | 50 days | Fri 4/17/26 | Sat 6/13/26 | 18SS+7 days |
| 21 | PEKERJAAN PASANGAN | 46 days | Thu 4/30/26 | Mon 6/22/26 | |
| 22 | Pemasangan batu belah dengan Mortar tipe M, fc' = 17,2 | 46 days | Thu 4/30/26 | Mon 6/22/26 | 20FF+7 days |
| 23 | Pemasangan pipa suling-suling | 13 days | Mon 6/8/26 | Mon 6/22/26 | 22FF |
| 24 | Pekerjaan plesteran 1 SP : 3 PP tebal 15 mm | 8 days | Sat 6/13/26 | Mon 6/22/26 | 22FF |

**Figure 2.** Accelerated Project Schedule Using the Fast Track Method in Microsoft Project

Based on the project schedule developed in Microsoft Project using the Fast Track method, the accelerated schedule resulted in a total project duration of 82 days. This indicates that the implementation of overlapping activities on the critical path successfully reduced the overall project duration compared with the original schedule, while maintaining the logical sequence of construction activities. The reduction in project duration demonstrates that the Fast Track method can effectively improve schedule performance by allowing selected activities to be executed concurrently without significantly affecting project execution.

## CONCLUSION

Delays in river embankment construction can hinder the timely completion of infrastructure intended to mitigate flooding and slope failure. This study aimed to assess schedule acceleration using the fast-track method for stone masonry work on the Kedunglarangan River Improvement Project in Pasuruan Regency, Indonesia. The analysis used project schedules, work breakdown structures, activity quantities, and field productivity data to identify remaining activities and establish scheduling relationships in Microsoft Project. Critical activities were rescheduled through overlapping execution, with selected finish-to-start (FS) relationships modified to start-to-start (SS) relationships using specified time lags. The project experienced an approximately 10% progress shortfall between Weeks 2 and 8, requiring adjustments to the remaining structural and masonry work. The accelerated schedule resulted in a total project duration of 82 days, compared with the original duration of 94 days, representing a reduction of 12 days, or approximately 12.77%. These findings indicated that overlapping critical activities could shorten the construction schedule while maintaining the necessary activity dependencies. However, quantified cost outcomes were not provided, preventing conclusions regarding potential cost savings. The study concluded that the fast-track method provided a viable scheduling alternative for the project, subject to verification of activity dependencies, resource availability, and construction feasibility prior to field implementation.

**FUNDING**

This research did not receive special funding from governmental, commercial, or non-profit organizations.

**CONFLICT OF INTEREST**

The author states that there is no conflict of interest in the preparation of this article.

**AUTHOR CONTRIBUTIONS**

All authors contributed to conceptualization, search and synthesis of literature, interpretation of results, manuscript preparation, and critical review of manuscripts. All authors have read and approved the final version of the manuscript.

**GENERATIVE AI STATEMENT**

The authors declare that Generative Artificial Intelligence (Generative AI) was used solely to assist with language refinement, grammatical correction, and improvement of manuscript readability. All scientific concepts, interpretations, literature synthesis, analyses, and conclusions were developed by the authors. All AI-assisted content was carefully reviewed, verified, and revised by the authors, who take full responsibility for the accuracy, integrity, and final content of the manuscript.

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