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The Use of Type D and Type F Admixtures Concrete and Their Effects on Setting Time and Compressive Strength

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ABSTRACT

The challenges of concrete usage in Indonesia, such as hot weather, remote construction sites, and improper manual casting practices, often lead to reduced concrete quality due to excessive water addition. This study investigates the effects of Type D (Sika-Plastiment-83am) and Type F (Sikament-LN) admixtures on concrete's setting time and compressive strength to address these issues. The research aims to optimize admixture dosages (0.2%, 0.25%, and 0.3% by cement weight) to enhance concrete performance while adhering to SNI and ASTM standards. Methods included literature reviews, field studies, and laboratory tests, such as slump tests, compressive strength tests (at 7, 14, and 28 days), and initial setting time measurements using penetrometers. Findings revealed that admixtures significantly improved compressive strength (31.6–34.0 MPa, exceeding the 30.0 MPa target) and extended initial setting times (3 hours 45 minutes to 5 hours 10 minutes) compared to untreated concrete (2 hours 20 minutes). The optimal dosage balanced workability (slump: 12±2 cm) and delayed hardening, ensuring suitability for casting. The study concludes that admixtures effectively replace water addition, enhancing strength and workability while mitigating premature drying. Practical implications include recommendations for admixture use in hot climates and remote projects to maintain concrete quality and durability.

Keywords: admixture type D and F, concrete, compressive strength, setting time, initial setting time

INTRODUCTION

Infrastructure across all regions of Indonesia ranks 27th in the Global Quality Infrastructure Index 2023, confirming its position as the country with the best quality infrastructure in ASEAN. Collaboration between the government, the private sector, and the community is the key to this success (as reported by the Indonesia Information Portal *www.indonesia.go.id*, Author: Dwitri Waluyo).

The use of concrete materials is a major component in infrastructure development (Rahman et al., 2020; Sharma et al., 2022; Unis Ahmed et al., 2022). To maintain concrete quality according to standards, the general public requires literature or references to applicable regulations, which must be understood and implemented by all parties involved in the construction stage (Hidayawanti et al., 2020; Lee et al., 2022; Pandey & Kumar, 2022; Skocek et al., 2024; Tutu et al., 2022). This also applies to individual development such as residential houses, independent development from village funds for building roads in villages, schools, health centers, and other public facilities. In general, well-maintained concrete quality is typically achieved by corporations or companies specializing in batching plants and *ready mix* by implementing regulations related to concrete quality.

Concrete is the primary material in construction, consisting of a mixture of cement, water, aggregate, and other additives to improve the performance and durability of the structure (Blaževska-Stoilkovska et al., 2015; Farid et al., 2019; Sawan et al., 2018; Tesema et al., 2021;

Waldman et al., 2020). In its development, the use of additive materials has become a solution to optimize the properties of concrete according to project needs. According to *SNI* and *ASTM*, additives are materials added to change the properties of concrete. Additives are classified into major groups, namely:

- Drying acceleration
- Setting time slowdown
- Plasticizer for flexibility
- Superplasticizer for high workability

SNI 2847:2019 regulates the requirements for structural concrete in buildings, including the use of additives (*admixtures* or additives) to achieve desired concrete performance, such as strength, durability, and smoothness of casting. *SNI 03-2495-1991* regulates the specifications of additive materials for concrete, including physical and chemical requirements. These additives can be used to reduce the moisture content of the mixer, regulate the setting time, or improve other properties of concrete. *SNI 03-2834-2000* regulates procedures for making normal concrete mix plans, including the use of additives. According to *ASTM* (American Society for Testing and Materials), standards also regulate the use and types of additives in concrete, especially through the *ASTM C494* standard, which distinguishes additives based on their function, such as water-reducing, accelerating, or retarding. One type of additive often used is Type D and Type F, which function to modify the characteristics of fresh and hardened concrete.

The mechanism of additives in concrete involves their effect on hydration: additives accelerate or slow down the chemical reactions of cement and water. They also improve workability, making mixing and installation easier, and help regulate the setting time for work efficiency.

Type D and Type F additives play an important role in controlling setting time and concrete quality. Type D (*Water-Reducing and Retarding Admixture*) additives have a dual function: reducing the amount of mixing water required to produce concrete with a certain consistency and inhibiting initial setting. *Water Reducing and Retarding Admixtures* are water reducers and drying controllers, used to add strength to concrete and reduce cement content proportional to the reduction in water content. This material is almost entirely in liquid form, and the water it contains becomes part of the concrete mixture water. In planning, this water should be added to the total weight of water in the concrete mixture. It is important to maintain the ratio between *mortar* and coarse aggregate. Any changes in the content of water, air, or cement must be compensated by changes in the content of fine aggregates to maintain the volume.

Meanwhile, F-type additives (*High-Range Water Reducer / Superplasticizer*) are used to increase the workability of concrete without increasing the amount of water, resulting in higher concrete strength.

The calculation of the dosage of additives is based on the weight of cement. Admixture dosage rate :

a. Per 100 kg of cementitious material.
b. Liter per cubic meter
c. Milliliters (ml) per cubic meter of concrete.

With the use of additives, one of the goals is to achieve compressive strength according to specifications. The calculation for compressive strength is:

$fc' = P/A$

Where:

- fc' = compressive strength of concrete (MPa)
- P = maximum load when concrete is crushed (N)

- A = concrete cross-sectional area (mm2), for cylinders

Analysis of the results involves comparing the compressive strength value of the concrete to the design value (e.g., K-250, K-300, or K-400). If the test value is higher than the design value, the mixture is declared eligible. If it is lower, it is necessary to re-evaluate the mix design or the implementation of mixing and curing.

In this study, tests were carried out on various variations of concrete mixtures with certain additives, namely *retardar* and *superplasticizer* types. The results of the compressive strength test are used to determine the effect of additives on the strength of concrete at a given age and become the basis for determining the best mixture formulation[A1].

Concrete is a fundamental material in construction, yet its performance is often compromised by environmental factors and improper practices, particularly in regions like Indonesia with hot climates and remote construction sites. Previous studies have explored the use of chemical admixtures to enhance concrete properties, such as workability and strength. For instance, research by Wibowo et al. (2023) demonstrated the effectiveness of retarders in delaying setting times, while Sudika et al. (2017) highlighted the role of admixtures in improving compressive strength. However, these studies often focused on single admixture types or lacked comprehensive evaluations under real-world conditions, leaving gaps in understanding the combined effects of Type D (water-reducing and retarding) and Type F (superplasticizer) admixtures on both setting time and strength. This gap underscores the need for a holistic approach to admixture application, especially in challenging environments.

The urgency of this research stems from widespread field issues, such as the common but detrimental practice of adding excess water to concrete mixtures to improve workability, which significantly weakens compressive strength. In remote or hot-weather projects, premature drying and stiffening of concrete further complicate casting processes, leading to structural defects. Despite the availability of admixtures, their adoption remains limited due to a lack of accessible guidelines and empirical data tailored to local conditions. Addressing these challenges is critical to ensuring the durability and safety of infrastructure, particularly in developing regions where construction quality directly impacts economic growth and public welfare.

This study introduces novelty by systematically evaluating the dual effects of Type D and Type F admixtures on concrete performance, combining laboratory tests with real-world field studies to bridge the gap between theory and practice. Unlike previous research, this work examines dosage variations (0.2%, 0.25%, and 0.3%) to identify optimal levels for balancing setting time and compressive strength under tropical conditions. Additionally, the study integrates adherence to *SNI* and *ASTM* standards, providing a standardized framework for practitioners. By focusing on locally available admixtures like *Sika-Plastiment-83am* and *Sikament-LN*, the research offers practical solutions tailored to Indonesia's construction needs.

The primary objective of this research is to determine the optimal dosage of Type D and Type F admixtures that enhances concrete's compressive strength and extends its setting time without compromising workability. Through slump tests, compressive strength measurements, and penetrometer-based setting time analyses, the study aims to establish clear correlations between admixture levels and concrete performance. The findings will provide actionable insights for optimizing mix designs in hot and remote environments, ensuring compliance with industry standards while addressing practical challenges faced by construction teams.

The benefits of this research extend beyond academic contributions, offering tangible advantages for industry stakeholders. By validating the effectiveness of admixtures in improving concrete quality, the study encourages the adoption of best practices, reducing reliance on water addition and mitigating premature hardening. Contractors and engineers can leverage the results to enhance project efficiency, reduce material waste, and improve structural longevity. Furthermore, the research supports Indonesia's infrastructure goals by promoting cost-effective, sustainable construction methods, ultimately contributing to safer and more resilient built environments.

METHOD

The research methodology employed consists of *literature studies* and *field studies* (projects). The *literature studies* encompass textbooks, regulations, national and international standards, as well as previously published journals. This *literature study* is conducted to explore material that is relevant to the aims and objectives of the study. The *field study* involves creating test specimens in the form of fresh concrete with *f'c* 30 MPa quality, both without additives and with the addition of type D and type F additives at varying levels. The concrete specimens are tested for initial setting during the delivery of *ready-mix* concrete and for compressive strength at the ages of 7 days, 14 days, and 28 days. Data collection was conducted at the Gatot Subroto Hospital Pump House Project in Central Jakarta with the contractor PT. Citra Nusa Padjadjaran. The batching plant used for this research is located at the Tanah Abang Plant, Central Jakarta, owned by PT. Adhimix RMC Indonesia.

The following section presents a flowchart and an explanation of the main steps undertaken in the research process.

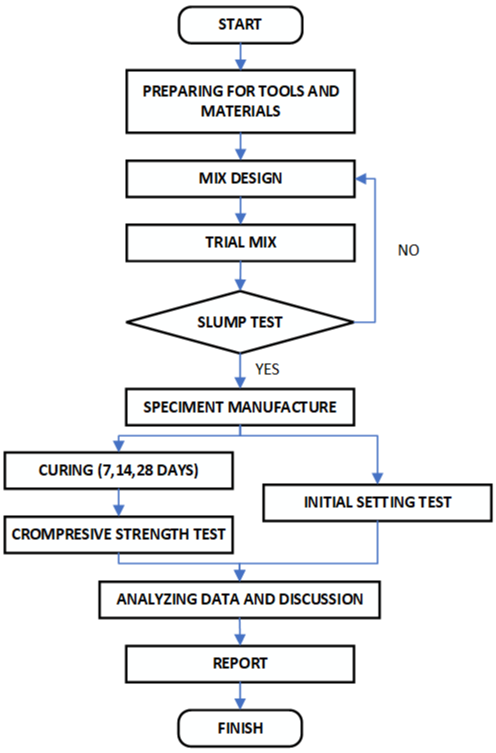


Figure 1. *Flow chart* Methodology

Concrete Mix Design* dan *Trial Mix

Concrete mix design is an important process in making concrete, as it determines the proportion of constituent materials such as cement, fine aggregate (*sand*), coarse aggregate (*gravel*), water, and additives. The main goal of *concrete mix design* is to produce concrete that meets the requirements for strength, durability, workability, and cost efficiency according to project conditions.

In this study, the concrete mixture was designed in accordance with *SNI 03-2834-2000* and *SNI 7656:2012* rules, taking into account the use of *Sika-Plastiment-83am* and *Sikament-LN* type D additives as variables. The mixture ratio is prepared using the *trial mix* method to obtain the optimal proportion, and a *slump test* is carried out to determine workability, while a compressive strength test is conducted to assess the final performance of the concrete. The effect of additive variations on concrete yield was analyzed to determine their effectiveness in improving the overall quality of concrete.

The manufacture of *concrete mix design* (concrete mix design) for normal concrete is carried out by PT. Adhimix RMC Indonesia, with the addition of variations in the level of type D and F additives in this study following *ASTM C494* "Standard Specification for Chemical Admixture for Concrete." The additive content used is 0%, 0.20%, 0.25%, and 0.30% Liter of the weight of cement. The fresh concrete produced uses the *concrete mix design* implemented in the aforementioned project. The *concrete mix design* of concrete with variations in additive levels is presented in Table 1.

Table 1. *Concrete Mix Design* Without and With Additives

Uji No	Grade (fc')-Mpa	Max. Agg. (mm)	w/c ratio	Slump (cm)	Semen (kg)	Air (liter)	Pasir (kg)	Gravel (kg)	Super plasticizer (liter)	Retarder (liter)
Uji 1	30	25	0.47	14	383	181	788	1.003	2,1	0,77 (0,2%)
Uji 2	30	25	0.55	13	348	182	821	998	1,7	0,87 (0,3%)
Uji 3	30	25	0.55	13	383	181	788	1.003	2,1	0,96 (0,25%)
Uji 4	30	25	0.47	13	383	181	788	1.003	0	0

Concrete Slump Testing

In this study, concrete *slump* testing was conducted to evaluate the effect of adding additives on the workability of concrete. For example, the addition of a *superplasticizer* is expected to increase the *slump* value without adding water, which is very useful for maintaining the compressive strength of concrete. Conversely, if the concrete exhibits too low a *slump*, it tends to be stiff and difficult to work with, potentially leading to voids or structural defects.

The testing procedure is as follows:

- Fresh concrete is placed into a frustum-shaped metal cone (*slump cone*) in three layers, with each layer compacted 25 times using a compactor rod.
- Once the cone is filled, it is lifted vertically and slowly within approximately ±5 seconds.
- The concrete will experience a *slump*. The difference between the height of the cone and the height of the concrete after slumping is measured and recorded in millimeters.

A comparison of *slump* values from various mixture variations provides preliminary information about the suitability of the concrete for field implementation methods. These results are then combined with other tests, such as compressive strength and setting time tests, to provide a comprehensive evaluation of concrete performance.

Figure 2. The *Slump Test process* in the field *is at* the Gatot Subroto Hospital Pump House Project in Central Jakarta with Contractor PT. Citra Nusa Padjadjaran

Concrete Compressive Strength Testing

Concrete used in structures such as beams, columns, slabs, and foundations must have compressive strength values that meet technical standards. This test is conducted in accordance with the *SNI 1974:2011* standard or *ASTM C39/C39M – Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens*.

The main purposes of this test are as follows:

- To determine the maximum compressive strength that concrete can withstand at a given age (generally 7, 14, and 28 days), where the comparison of concrete strength at various ages refers to the *Indonesian Concrete Regulation (PBI-1971)*.
- To evaluate the effect of variations in mixtures or additives on the quality of concrete.
- To determine whether the concrete meets the structural planning specifications.

This process ensures that the concrete used in critical structural elements is reliable, safe, and compliant with both national and international standards.

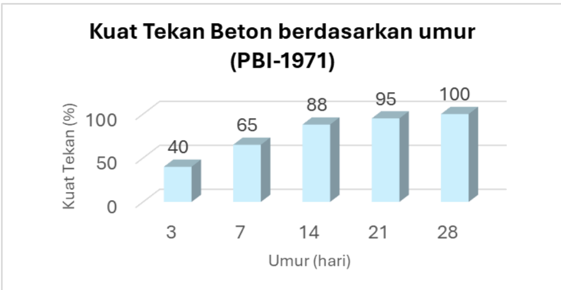


Figure 3. Compressive Strength of Concrete by Age according to PBI-1971

The testing procedure is as follows:

- *Specimen Manufacture and Treatment*: Fresh concrete is molded in standard cylinders measuring 150 mm in diameter and 300 mm in height. After 24 hours, the test specimen is immersed in water (*curing*) until the designated test age is reached.
- *Test Preparation*: The upper and lower surfaces of the test specimen are leveled and cleaned before being placed on the pressure testing machine.
- *Testing*: The specimen is positioned vertically on the pressure testing machine. The load is applied evenly and continuously until the specimen fails.

In this study, tests were conducted on various concrete mixture variations containing certain additives. The results of the compressive strength tests are used to determine the effect of additives on the strength of concrete at specific ages and serve as the basis for identifying the best mixture formulation.

Concrete Setting Time Testing

Setting time in concrete refers to the period required for concrete to transition from a liquid to a solid state and achieve sufficient strength. This parameter is crucial for determining when concrete can be handled, treated, and utilized in construction. The calculation of concrete setting time is essential for assessing whether the concrete is suitable for pouring, which significantly impacts its compressive strength. This test refers to *ASTM C403/C403M:2012* regarding the "Method of Setting Time Test of Concrete Mixtures with Penetration Resistance."

In general, setting time is divided into two categories:

- **Initial Setting Time**: The stage where the concrete start binding or hydration process has started, hydration heat is generated, and the workability of the concrete is lost.
- **Final Setting Time**: The stage where the concrete has fully hardened.

To determine the initial and final setting times, the test is conducted until the mixture or fresh concrete mortar reaches a penetration resistance of 500 psi (3.5 MPa) for the initial setting and 4000 psi (27.6 MPa) for the final setting. The procedure involves using mortar that passes through sieve no. 4 (4.75 mm) from fresh concrete. The mortar is then tested at regular intervals using a penetration resistance device. The readings at 500 psi and 4000 psi are recorded, and the results are presented in tables and graphs.

In this study, testing was performed on the initial setting up to the penetrometer reading of 500 psi. The final setting time refers to journal references (Wibowo, Endah Safitri, Angela Ayu Putri, 2023), and environmental factors such as temperature were also documented.

Concrete Initial Setting Time Testing

The purpose of testing the initial setting time of concrete is to determine how long it takes for the fresh concrete mixture to begin losing its plastic properties and start hardening. This parameter is vital in construction, particularly for scheduling casting, compaction, and surface finishing. The test follows the *ASTM C403* standard, where the initial setting time is determined based on penetration resistance measured with a needle penetrometer. Testing is performed on samples of paste, mortar, or concrete without coarse aggregates, prepared with the same mixture proportions as the actual concrete.

The testing procedure is as follows:

- The fresh concrete mixture is filtered by Sieve No. 4 to remove coarse aggregates, producing a fine mortar.
- The sample is placed into a cube mold approximately 150 mm x 150 mm x 150 mm in height.
- A penetrometer is used to measure the penetration resistance of the needle at regular intervals, typically every 15–30 minutes after mixing begins.
- Measurements continue until the penetration resistance reaches 500 psi (3.45 MPa), marking the initial setting time.
- The results are plotted on a graph showing the relationship between time and penetration resistance to determine the exact moment the 500 psi value is reached.

The initial setting time indicates how quickly the concrete begins to harden after mixing. The sooner the 500 psi value is reached, the faster the concrete hardens. Factors influencing this time include temperature, water-cement ratio, type of cement, and the presence of additives such as *retarders* (which slow down) or *accelerators* (which speed up) the setting time process.

In this study, tests were conducted to compare the effects of different types of additives on the initial setting time of concrete. The results are used to evaluate whether the additives employed are suitable for specific project conditions, such as mass casting projects that require extended working times or rapid repair projects that demand shorter setting times.

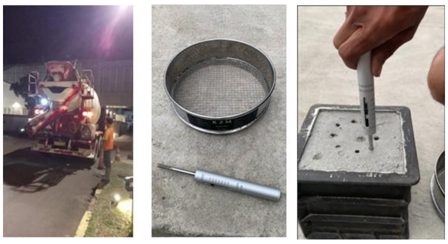


Figure 4. The *initial setting test process* in the field *was at* the Gatot Subroto Hospital Pump House Project in Central Jakarta with a contractor PT. Citra Nusa Padjadjaran

RESULT AND DISCUSSION

This study discusses the effect *of the addition of* additives type D *Sika-Plastiment-83am* and type F *Sikament-LN* on the quality of concrete both in terms of compressive strength and setting time, especially *the initial setting* which greatly affects its *workability* so that fresh concrete is still suitable for pouring or still in accordance with *the quality specifications.*

Concrete Compressive Strength Test Results

From the laboratory testing process, the results were obtained between not using *additives* compared to using *additives* with various varying degrees. Where by using additional additives, good results are obtained and even exceed the quality target of concrete compressive strength fc'30 Mpa. Both tests start from the age of 7 days, 14 days which are converted according to the 1971 PBI. Nor the age of concrete at 28 days.

Table 2. Comparison of compressive strength test results of concrete without and with additives added

Tanggal	Uji No	Kadar Aditif	Dimension Cylinder (D x L cm)	Grade (fc') - Mpa	Tes Kuat Tekan 7 hari (MPa)	Tanggal Test 7 hari	Tes Kuat Tekan 14 hari (MPa)	Tanggal Test 14 hari	Tes Kuat Tekan 28 hari (MPa)	Tanggal Test 28 hari	Check test 7 hari		Check test 14 hari		Check test 28 hari	
6-Mar-25	Uji 1	0.20%	15 x 30	30	23.8	13-Mar-25	28.2	20-Mar-25	31.6	3-Apr-25	OK	79%	OK	94%	OK	105%
10-Mar-25	Uji 2	0.30%	15 x 30	30	23.1	17-Mar-25	28.4	24-Mar-25	31.9	7-Apr-25	OK	77%	OK	95%	OK	106%
16-Mar-25	Uji 3	0.25%	15 x 30	30	23.3	23-Mar-25	28.3	30-Mar-25	34.0	13-Apr-25	OK	78%	OK	94%	OK	113%
5-Apr-25	Uji 4/ Tanpa aditif	0%	15 x 30	30	18.5	12-Apr-25	23.6	19-Apr-25	28.5	3-May-25	NOT OK	62%	NOT OK	79%	NOT OK	95%

Figure 5. Comparison of compressive strength test results of concrete without and with additives added

Initial Setting Time Test Results

The results of the concrete initial setting time test with varying dosages of Type D additive (Sika-Plastiment-83am) and Type F additive (Sikament-LN) are presented in the form of a table and a graph showing the relationship between the elapsed time since the mixing of concrete materials and the penetration resistance value, as shown in the figure. Based on the figure, the initial setting time of the concrete is determined at a penetration resistance of 500 psi.

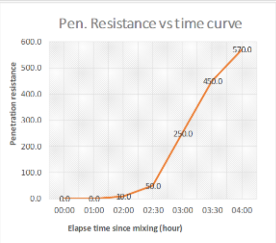
In this study, the final setting time of the concrete—defined at a penetration resistance of 4000 psi—refers only to the ASTM C 494/C 494 M standard. This is because, in practical terms, once the concrete reaches its final setting, it is no longer suitable for placement or does not meet quality specifications. The results of the initial setting time test on fresh concrete, both without additives and with variations in additive dosage, are presented in the following graph:

FORM PENGUJIAN INITIAL SETTING ASTM C-403

Nama Area Proyek	:	SLAB- P ROOM RSPAD JAKARTA	Nomor Sample :	T Al
Tanggal	:	6 Mar 25	Start Pengecoran :	14:30 WIB
Mutu Beton	:	FC 30 SLUMP 12 ± 2	Volume Sample	0.03 m3
Suhu	:	31 °C	Jumlah Sample	6 (4 kuat tekan, 2 initial setting)

INITIAL SETTING TIME ASTM C 403

Time	Penetration Reading PSI		Elapse time since mixing (hour)
14:30	500	0.0	0:00
15:30	500	0.0	1:00
16:30	500	10.0	2:00
17:00	500	50.0	2:30
17:30	500	250.0	3:00
18:00	500	450.0	3:30
18:30	500	570.0	4:00



Initial Setting (500 P : 3 jam 45 Menit

SLUMP WORKABILITY CHECK

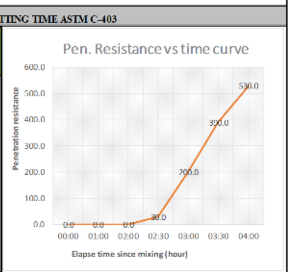
Jam	Slump (cm)	Durasi sejak Awal Cor (jam)	deviasi terhadap slump minimum 10	Hasil Periksa
14:30	14.0	0:00	4.0	OK
15:30	13.0	1:00	3.0	OK
16:30	12.5	2:00	2.5	OK
17:30	12.0	3:00	2.0	OK
18:30	10.5	4:00	0.5	OK
19:00	8.5	4:30	-1.5	NOT OK

FORM PENGUJIAN INITIAL SETTING ASTM C-403

Nama Area Proyek	:	SLAB- P ROOM RSPAD JAKARTA	Nomor Sample :	T Al
Tanggal	:	6 Mar 25	Start Pengecoran :	14:30 WIB
Mutu Beton	:	F'C 30 SLUMP 12 ± 2	Volume Sample :	0.03 m3
Suhu	:	31 °C	Jumlah Sample :	6 (4 kuat tekan, 2 initial setting)

INITIAL SETTING TIME ASTM C-403

Time	Penetration Reading PSI		Elapse time since mixing (hour)
14:30	500	0.0	0:00
15:30	500	0.0	1:00
16:30	500	0.0	2:00
17:00	500	30.0	2:30
17:30	500	200.0	3:00
18:00	500	390.0	3:30
18:30	500	530.0	4:00



Initial Setting (500 : 3 jam 50 Menit

SLUMP WORKABILITY CHECK

Jam	Slump (cm)	Durasi sejak Awal Cor (jam)	deviasi terhadap slump minimum 10	Hasil Periksa
14:30	14.0	0:00	4.0	OK
15:30	13.0	1:00	3.0	OK
16:30	12.5	2:00	2.5	OK
17:30	12.0	3:00	2.0	OK
18:30	10.5	4:00	0.5	OK
19:00	8.5	4:30	-1.5	NOT OK

Figure 6. Initial *setting test* results on fresh concrete with *additive* content of 0.2%

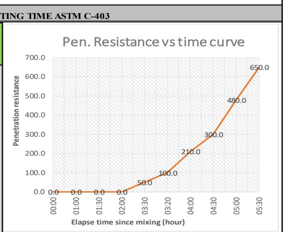
From the results of the fresh concrete test at an ambient temperature of 31° degrees *Celsius* with the addition of *additives with* a content of 0.2% of the cement weight, *an initial setting* with 500 Psi was obtained in the range of 3 hours 45 minutes to 3 hours 50 minutes. And with *a slump test value* between 10.5 to 14 cm (still within the requirement of 12±2 cm).

FORM PENGUJIAN INITIAL SETTING ASTM C-403

Nama Area Proyek	:	KOLOM- P ROOM RSPAD JAKARTA	Nomor Sample :	T B1
Tanggal	:	10 Mar 25	Start Pengecoran :	15:10 WIB
Mutu Beton	:	F'C 30 SLUMP 12 ± 2	Volume Sample	0.04 m3
Suhu	:	33 °C	Jumlah Sample	8 (6 kuat tekan, 2 initial setting)

INITIAL SETTING TIME ASTM C-403

Time	Penetration Reading PSI		Elapse time since mixing (hour)
15:10	500	0.0	0:00
16:10	500	0.0	1:00
16:40	500	0.0	1:30
17:10	500	0.0	2:00
18:40	500	50.0	3:30
18:30	500	100.0	3:20
19:10	500	210.0	4:00
19:40	500	300.0	4:30
20:10	500	480.0	5:00
20:40	500	650.0	5:30



Initial Setting (500 Ps : 5 jam 5 Menit

SLUMP - WORKABILITY CHECK

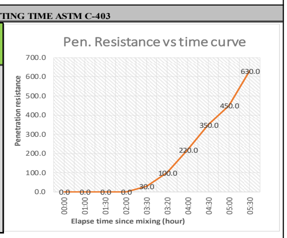
Jam	Slump (cm)	Durasi sejak Awal Cor (jam)	deviasi terhadap slump minimum 10	Hasil Periksa
15:10	13.0	0:00	3.0	OK
16:10	13.0	1:00	3.0	OK
17:10	12.0	2:00	2.0	OK
18:10	12.0	3:00	2.0	OK
19:10	11.0	4:00	1.0	OK
20:10	10.0	5:00	0.0	LIMIT

FORM PENGUJIAN INITIAL SETTING ASTM C-403

Nama Area Proyek	:	KOLOM- P ROOM RSPAD JAKARTA	Nomor Sample :	T B1
Tanggal	:	10 Mar 25	Start Pengecoran :	15:10 WIB
Mutu Beton	:	F'C 30 SLUMP 12 ± 2	Volume Sample	0.04 m3
Suhu	:	33 °C	Jumlah Sample	8 (6 kuat tekan, 2 initial setting)

INITIAL SETTING TIME ASTM C-403

Time	Penetration Reading PSI		Elapse time since mixing (hour)
15:10	500	0.0	0:00
16:10	500	0.0	1:00
16:40	500	0.0	1:30
17:10	500	0.0	2:00
18:40	500	30.0	3:30
18:30	500	100.0	3:20
19:10	500	220.0	4:00
19:40	500	350.0	4:30
20:10	500	450.0	5:00
20:40	500	630.0	5:30



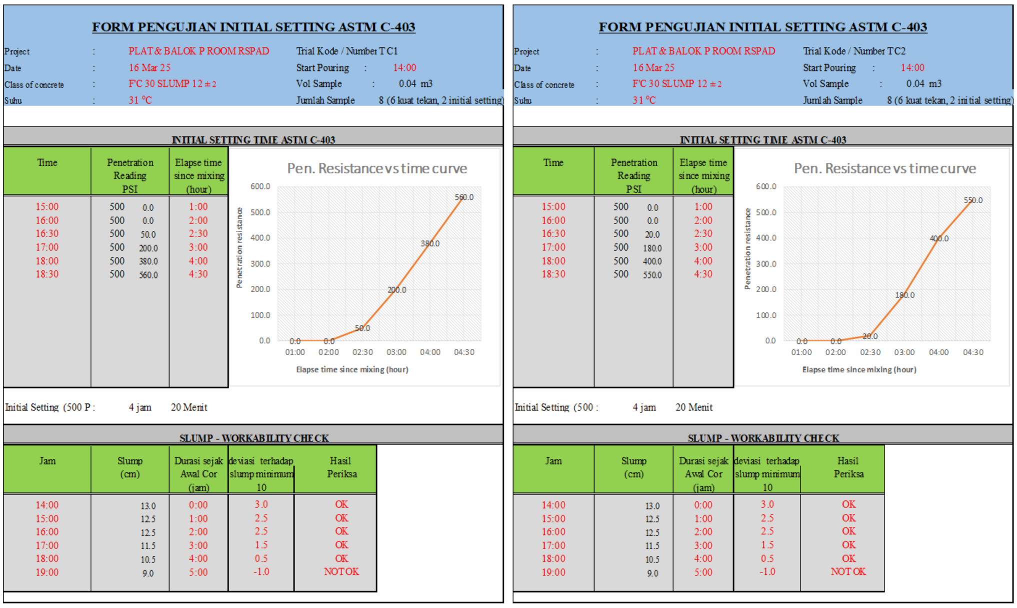
Initial Setting (500 Ps : 5 jam 10 Menit

SLUMP - WORKABILITY CHECK

Jam	Slump (cm)	Durasi sejak Awal Cor (jam)	deviasi terhadap slump minimum 10	Hasil Periksa
15:10	13.0	0:00	3.0	OK
16:10	13.0	1:00	3.0	OK
17:10	12.0	2:00	2.0	OK
18:10	12.0	3:00	2.0	OK
19:10	11.0	4:00	1.0	OK
20:10	10.0	5:00	0.0	LIMIT

Figure 7. Initial *setting test* results on fresh concrete with *additive* content of 0.3%

From the results of the fresh concrete test at an ambient temperature of 33° degrees *Celsius* with the addition of *additives* with a content of 0.3% of the cement weight, *an initial setting* with 500 Psi was obtained in the range of 5 hours 5 minutes to 5 hours 10 minutes. And with *a slump test value* between 11 to 13 cm (still within the requirement of 12±2 cm).



FORM PENGUJIAN INITIAL SETTING ASTM C-403

Project : PLAT & BALOK P ROOM RSPAD — Trial Kode / Number TC1
Date : 16 Mar 25 — Start Pouring : 14:00
Class of concrete : F'C 30 SLUMP 12 ± 2 — Vol Sample : 0.04 m3
Suhu : 31 °C — Jumlah Sample 8 (6 kuat tekan, 2 initial setting)

INITIAL SETTING TIME ASTM C-403

Time	Penetration Reading PSI		Elapse time since mixing (hour)
15:00	500	0.0	1:00
16:00	500	0.0	2:00
16:30	500	50.0	2:30
17:00	500	200.0	3:00
18:00	500	380.0	4:00
18:30	500	560.0	4:30

Initial Setting (500 P : 4 jam 20 Menit

SLUMP - WORKABILITY CHECK

Jam	Slump (cm)	Durasi sejak Awal Cor (jam)	deviasi terhadap slump minimum 10	Hasil Periksa
14:00	13.0	0:00	3.0	OK
15:00	12.5	1:00	2.5	OK
16:00	12.5	2:00	2.5	OK
17:00	11.5	3:00	1.5	OK
18:00	10.5	4:00	0.5	OK
19:00	9.0	5:00	-1.0	NOT OK

FORM PENGUJIAN INITIAL SETTING ASTM C-403

Project : PLAT & BALOK P ROOM RSPAD — Trial Kode / Number TC2
Date : 16 Mar 25 — Start Pouring : 14:00
Class of concrete : F'C 30 SLUMP 12 ± 2 — Vol Sample : 0.04 m3
Suhu : 31 °C — Jumlah Sample 8 (6 kuat tekan, 2 initial setting)

INITIAL SETTING TIME ASTM C-403

Time	Penetration Reading PSI		Elapse time since mixing (hour)
15:00	500	0.0	1:00
16:00	500	0.0	2:00
16:30	500	20.0	2:30
17:00	500	180.0	3:00
18:00	500	400.0	4:00
18:30	500	550.0	4:30

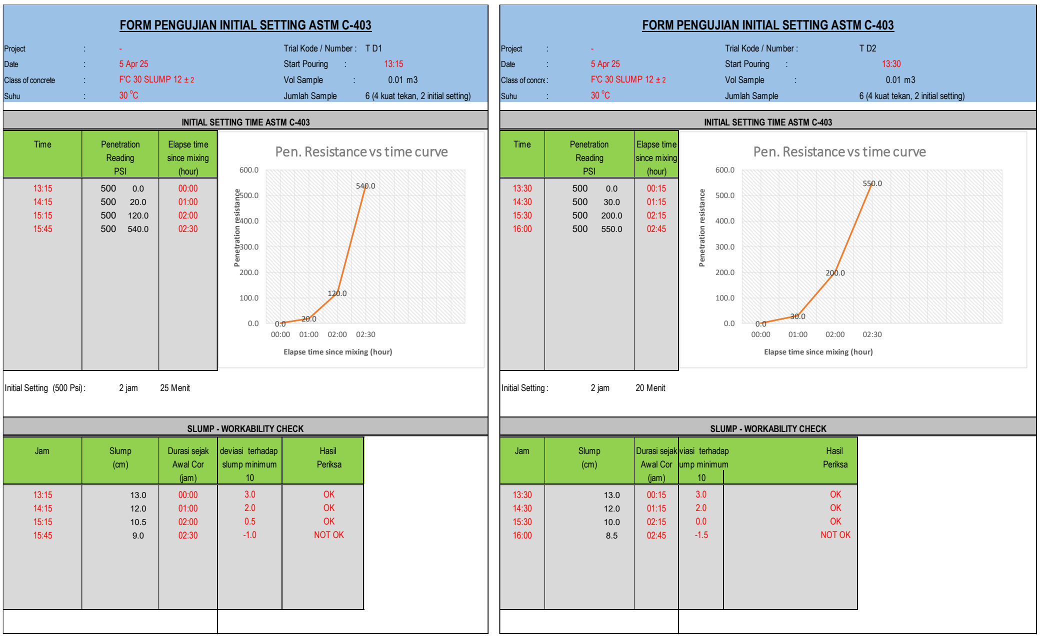
Initial Setting (500 : 4 jam 20 Menit

SLUMP - WORKABILITY CHECK

Jam	Slump (cm)	Durasi sejak Awal Cor (jam)	deviasi terhadap slump minimum 10	Hasil Periksa
14:00	13.0	0:00	3.0	OK
15:00	12.5	1:00	2.5	OK
16:00	12.5	2:00	2.5	OK
17:00	11.5	3:00	1.5	OK
18:00	10.5	4:00	0.5	OK
19:00	9.0	5:00	-1.0	NOT OK

Figure 8. Initial *setting test* results on fresh concrete with *additive* content of 0.25%

From the results of the fresh concrete test at an ambient temperature of 31° degrees Celsius with the addition of *additives with* a content of 0.25% of the weight of cement, *an initial setting* with 500 Psi was obtained in a time span of 4 hours and 20 minutes. And with *a slump test value* of between 10.5 to 13 cm (still within the requirement of 12±2 cm).



FORM PENGUJIAN INITIAL SETTING ASTM C-403

Project : - — Trial Kode / Number : T D1
Date : 5 Apr 25 — Start Pouring : 13:15
Class of concrete : F'C 30 SLUMP 12 ± 2 — Vol Sample : 0.01 m3
Suhu : 30 °C — Jumlah Sample 6 (4 kuat tekan, 2 initial setting)

INITIAL SETTING TIME ASTM C-403

Time	Penetration Reading PSI		Elapse time since mixing (hour)
13:15	500	0.0	00:00
14:15	500	20.0	01:00
15:15	500	120.0	02:00
15:45	500	540.0	02:30

Initial Setting (500 Psi) : 2 jam 25 Menit

SLUMP - WORKABILITY CHECK

Jam	Slump (cm)	Durasi sejak Awal Cor (jam)	deviasi terhadap slump minimum 10	Hasil Periksa
13:15	13.0	00:00	3.0	OK
14:15	12.0	01:00	2.0	OK
15:15	10.5	02:00	0.5	OK
15:45	9.0	02:30	-1.0	NOT OK

FORM PENGUJIAN INITIAL SETTING ASTM C-403

Project : - — Trial Kode / Number : T D2
Date : 5 Apr 25 — Start Pouring : 13:30
Class of concre : F'C 30 SLUMP 12 ± 2 — Vol Sample : 0.01 m3
Suhu : 30 °C — Jumlah Sample 6 (4 kuat tekan, 2 initial setting)

INITIAL SETTING TIME ASTM C-403

Time	Penetration Reading PSI		Elapse time since mixing (hour)
13:30	500	0.0	00:15
14:30	500	30.0	01:15
15:30	500	200.0	02:15
16:00	500	550.0	02:45

Initial Setting : 2 jam 20 Menit

SLUMP - WORKABILITY CHECK

Jam	Slump (cm)	Durasi sejak Awal Cor (jam)	viasi terhadap ump minimum 10	Hasil Periksa
13:30	13.0	00:15	3.0	OK
14:30	12.0	01:15	2.0	OK
15:30	10.0	02:15	0.0	OK
16:00	8.5	02:45	-1.5	NOT OK

Figure 9. Initial *setting test* results on fresh concrete without *additive*

From the results of the fresh concrete test at an ambient temperature of 31° degrees Celsius without the addition of *additives, an initial setting* with 500 Psi was obtained in a time span of 2 hours and 20 minutes to 2 hours and 25 minutes. And with *a slump test value* of between 10 to 13 cm (still within the requirement of 12±2 cm).

CONCLUSION

The addition of type D (*Sika-Plastiment-83am*) and type F (*Sikament-LN*) admixtures significantly improved concrete performance, yielding compressive strengths of 31.6–34.0 MPa that exceeded the 30.0 MPa target. This improvement is attributed to enhanced concrete density through microvoid filling and accelerated cement hydration. The initial setting time increased from 2 hours 20 minutes (without admixtures) to 3 hours 45 minutes – 5 hours 10 minutes (with 0.20%–0.30% admixtures) at 500 psi penetration, safely accommodating the typical 2-hour transit time of *ready-mix* trucks while maintaining excellent workability (12±2 cm *slump*). The optimal dosage should balance setting time requirements to prevent excessive hardening delays. This method effectively replaces the common but problematic practice of water addition, as these commercially available admixtures simultaneously enhance strength, workability, and setting time control, making them a practical solution for field applications.

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