PENGARUH *ADMIXTURE TYPE* F (*POLYCARBOXYLATE*) PADA *MIX DESIGN Fc'* 41,5 MPa TERHADAP NILAI KUAT TEKAN BETON

SKRIPSI

Diajukan untuk memenuhi sebagaian persyaratan dalam mencapai gelar
Sarjana Teknik Sipil Program Pendidikan Strata Satu (S1)

Oleh:

TRI RAHARJO

41187011190022

PROGRAM STUDI TEKNIK SIPIL
FAKULTAS TEKNIK DAN SAINS TERAPAN
UNIVERSITAS MUHAMMADIYAH INDONESIA
2026

HALAMAN PENGESAHAN SKRIPSI

Judul	: Pengaruh *Admixture Type* F *(polycarboxylate)* Pada *Mix Design Fc'* 41,5 MPa Terhadap Nilai Kuat Tekan Beton
Nama	: Tri Raharjo
NPM	: 41187011190022
Program Studi	: Teknik Sipil
Fakultas	: Teknik dan Sains Terapan

Bekasi, 28 Juli 2026

Disetujui oleh,

Dosen Pembimbing I	Dosen Pembimbing II
Ninik Paryati, S.T., M.T	Rika Sylviana, S.T., M.T.

Mengetahui,

Kaprodi Teknik Sipil

Universitas Muhammadiyah Indonesia

Eko Darma, S.T., M.T.

HALAMAN PERSETUJUAN SKRIPSI

Dinyatakan lulus setelah dipertahankan di depan tim penguji ujian sidang Skripsi
Sebagai program studi Teknik Sipil Fakultas Teknik dan Sains Terapan
Universitas Muhammadiyah Indonesia

PENGARUH *ADMIXTURE TYPE* F *(POLYCARBOXYLATE)* PADA *MIX DESIGN Fc'* 41,5 MPa TERHADAP NILAI KUAT TEKAN BETON

Nama	: Tri Raharjo
NPM	: 41187011190022
Program Studi	: Teknik Sipil
Fakultas	: Teknik dan Sains Terapan

Bekasi, 28 Juli 2026

TIM PENGUJI

Nama	Tanda Tangan
1. Fajar Prihesnanto, ST., M.T.	.....
2. Eko Darma, ST., M.T.	.....
3. Ir. Anita Mardiana Agussalim, ST., M.T., IPM ASEAN Eng.	.....

PERNYATAAN KEASLIAN PENELITIAN

Saya yang bertanda tangan di bawah ini:

Nama	: Tri Raharjo
NPM	: 41187011190022
Program Studi	: Teknik Sipil
Fakultas	: Teknik dan Sains Terapan
Email	: *brandalplant@gmail.com*

Dengan ini menyatakan bahwa sesungguhnya penelitian saya yang berjudul **PENGARUH *ADMIXTURE TYPE* F *(POLYCARBOXYLATE)* PADA *MIX DESIGN Fc'* 41,5 MPa TERHADAP NILAI KUAT TEKAN BETON**, penulisan sudah sesuai dengan teknik penulisan karya ilmiah yang berlaku umum. Apabila dikemudian hari dapat dibuktikan adanya unsur plagiarisme tersebut, saya bersedia menerima sanksi sesuai dengan peraturan perundangan yang berlaku.

Bekasi, 28 Juli 2026

Tri Raharjo

KATA PENGANTAR

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

Assalamua'laikum Warahmatullahi Wabarakatuh

Puji syukur penulis panjatkan kehadirat Allah Subhanahu Wa Ta'ala atas Rahmat dan karunia-nya sehingga penulis dapat menyelesaikan Skripsi ini dengan judul "**PENGARUH *ADMIXTURE TYPE* F *(POLYCARBOXYLATE)* PADA *MIX DESIGN Fc'* 41,5 MPa TERHADAP NILAI KUAT TEKAN BETON".**

Penulisan Skripsi ini diajukan untuk memenuhi salah satu persyaratan dalam memperoleh gelar Sarjana Teknik program Strata-1 Jurusan Teknik Sipil Fakultas Teknik Universitas Muhammadiyah Indonesia.

Dalam proses pelaksanaan hingga penyelesaian ini penulis telah menerima bimbingan dari berbagai pihak, untuk itu penulis mengucapkan terima kasih sebesar-besarnya kepada:

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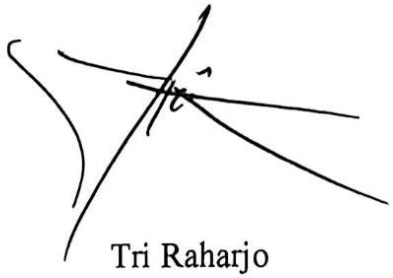
Penulis menyadari bahwa laporan ini masih terdapat kekurangan sehingga penulis mengharapkan kritik dan saran yang bersifat membangun demi kebaikan. Semoga penulisan penelitian ini dapat memberikan manfaat bagi semua pembaca. Akhir kata, penulis ucapkan terima kasih dan memohon maaf jika ada yang kurang dalam penulisan.

Wassalamualaikum Warahmatullahi Wabarakatuh

Bekasi, 28 Juli 2026

Penulis,



Tri Raharjo

LEMBAR ASISTENSI

Nama Mahasiswa : Tri Raharjo

NPM : 41187011190022

Dosen Pembimbing I : Ninik Paryati, S.T, M.T.

Dosen Pembimbing II: Rika Sylviana, S.T, M.T.

Judul Skripsi : Pengaruh *Admixture Type* F *(Polycarboxylate)* Pada *Mix Design Fc'* 41,5 MPa Terhadap Kuat Nilai Tekan Beton

No.	Tanggal	Uraian	Paraf
1	12 Juni 2026	- Perbaiki tata tulis dan lanjutkan bab IV. - Jangan taruh metode pada bab IV.	
2	27 Juni 2026	- Pada bab IV, perbaiki spasi 4.1 bukan tinjauan umum melainkan hasil penelitian. - Perhatikan peletakan sumber, berada di posisi pojok kiri tabel/gambar - Perbaiki penomoran, perhatikan jarak margin.	
3	10 Juli 2026	- Metode ada di bab III, usahakan jangan taruh di bab IV. - Letakan grafik M*ix Design* pada lampiran. - Perbaiki tata tulis.	

LEMBAR ASISTENSI

Nama Mahasiswa : Tri Raharjo

NPM : 41187011190022

Dosen Pembimbing : Ninik Paryati, S.T, M.T.

Dosen Pembimbing II: Rika Sylviana, S.T, M.T.

Judul Skripsi : Pengaruh *Admixture Type* F *(Polycarboxylate)* Pada *Mix Design Fc'* 41,5 MPa Terhadap Kuat Nilai Tekan Beton

No	Tanggal	Uraian	Paraf
4	17 Juli 2026	- Lengkapi data dan deskripsi untuk kuat tekan beton. - *Check* semua tata tulis. - Lanjutkan ke bab V. - Sertakan sumber pada kutipan. - Perhatikan sumber, sertakan instansi terkait dan tahun.	
5	23 Juli 2026	- ACC Sidang Seminar Hasil.	
4	27 Juli 2026	- ACC Sidang Skripsi.	

Pengaruh *Admixture Type* F *(Polycarboxylate)* Pada *Mix Design Fc'* 41,5 MPa Terhadap Kuat Nilai Tekan Beton

Tri Raharjo, 41187011190022

ABSTRAK

Perkembangan industri konstruksi yang pesat memicu peningkatan kebutuhan beton mutu tinggi dengan kuat tekan serta kemudahan pengerjaan *(workability)* yang optimal. Penelitian ini bertujuan untuk menganalisis pengaruh penambahan *chemical admixture* Tipe F berbasis *polycarboxylate* (*FBAS HPF-27*) terhadap nilai slump dan kuat tekan beton mutu rencana *fc'* 41,5 MPa (setara K-500) pada umur hidrasi 28 hari, sekaligus menentukan dosis pemakaian yang paling optimal. Metode eksperimental kuantitatif laboratorium diterapkan di PT. Adhimix PCI Indonesia Plant Cikarang dengan mengacu pada standar SNI 03-2834-2000 pada faktor air semen (FAS) konstan 0,43. Variasi dosis aditif yang diuji meliputi 0% (kontrol), 0,6%, 0,8%, dan 1,0% dari berat cementitious, dengan total 12 sampel silinder (Ø 10 cm x 20 cm) yang diberi faktor koreksi *L/D* sebesar 1,04 sesuai SNI 1974:2011. Hasil penelitian menunjukkan bahwa penambahan aditif meningkatkan nilai *slump* beton segar dari 120 mm (normal) hingga 165 mm pada dosis 1,0%. Pada umur 28 hari, nilai kuat tekan rata-rata konversi *L/D* meningkat dari 43,79 MPa (normal) menjadi 48,77 MPa pada dosis 0,6%, dan mencapai puncaknya pada dosis 0,8% sebesar 51,47 MPa disertai reduksi air hingga 16,54%. Namun, pada penambahan dosis 1,0% mengalami penurunan kuat tekan menjadi 50,36 MPa akibat melampaui titik jenuh aditif *(saturation point)*. Penelitian ini menyimpulkan bahwa penggunaan aditif *polycarboxylate* efektif meningkatkan kinerja beton mutu tinggi, dengan dosis pemakaian optimum berada pada persentase 0,8%.

Kata kunci: Beton, *Polycarboxylate*, *Slump*, Kuat Tekan, Dosis Optimum

The Effect of Type F Admixture (Polycarboxylate) in a 41.5 MPa Target Strength (Fc') Concrete Mix Design on Concrete Compressive Strength

Tri Raharjo, 41187011190022

ABSTRACT

Rapid developments in the construction industry have driven an increasing demand for high-strength concrete featuring optimal compressive strength and workability. This study aims to analyze the effect of adding Type F polycarboxylate-based chemical admixture (FBAS HPF-27) on the slump value and compressive strength of structural concrete with a target strength of fc' 41.5 MPa (equivalent to K-500) at 28 days of hydration, while determining the most optimal dosage. A quantitative laboratory experimental method was conducted at PT. Adhimix PCI Indonesia Plant Cikarang, adhering to the SNI 03-2834-2000 standard with a constant water-cement ratio (W/C) of 0.43. The admixture dosages tested were 0% (control), 0.6%, 0.8%, and 1.0% by weight of cementitious material, utilizing a total of 12 cylindrical specimens (Ø 10 cm x 20 cm) adjusted with an L/D correction factor of 1.04 in accordance with SNI 1974:2011. The results indicated that adding the admixture increased the fresh concrete slump value from 120 mm (control) up to 165 mm at a 1.0% dosage. At 28 days, the average L/D converted compressive strength increased from 43.79 MPa (control) to 48.77 MPa at 0.6%, reaching its peak at a 0.8% dosage with 51.47 MPa alongside a water reduction of 16.54%. However, increasing the dosage to 1.0% caused a decline in compressive strength to 50.36 MPa due to exceeding the admixture saturation point. This study concludes that polycarboxylate admixture effectively enhances the performance of high-strength concrete, with an optimal application dosage of 0.8%.

Keywords: Concrete, Polycarboxylate, Slump, Compressive Strength, Optimal Dosage

DAFTAR ISI

DAFTAR GAMBAR

DAFTAR TABEL

DAFTAR NOTASI

fc'	=	Kuat Tekan Karakteristik (MPa)
K	=	Kuat Tekan Karakteristik (Kg/cm^2)
Fcr'	=	Kuat Tekan Rencana (MPa)/ *Target Mean Strenght*
k	=	Koefisien Cacat
S	=	Standar Deviasi
M	=	*Margin*
fck'	=	Kuat Tekan Kubus 15x15x15 (Kg/cm^2)
σ' bk	=	Kuat Tekan Karakteristik (Kg/cm^2)(PBI.1971)
σ' bm	=	Kuat Tekan Rata-rata dari Sekumpulan Benda Uji
B-0	=	Klasifikasi Beton Mutu Rendah *(Non-Structural)*
B-1	=	Klasifikasi Beton *Non-Structural* dengan Mutu Beton Berkisar 10 – 12 MPa (PBI-1971)
ASTM	=	*American Soecity for Testing and Materials*
ACI	=	*American Concrete Institute*
DoE	=	*Departement of Environment (United Kingdom)*
PCE	=	*Polycarboxylate*
SNF	=	*Sulfonated Napthalene Formaldehyde*
SMF	=	*Sulfonated Melamine Formldehyde*
MLS	=	*Modifed Lignosulfonates*
HRWR	=	*High Range Water Reducer*
OPC	=	*Ordinary Portland Cement*
PPC	=	*Portland Pozzolan Cement*
PCC	=	*Portland Composite Cement*

LAMPIRAN

Lammpiran Kadar Hasil Pengujian Kadar Lumpur Agregat Halus.

AMOUNT OF MATERIAL FINER THAN 0.075 MM

(NO.200) SIEVE IN AGGREGATE

ASTM C-117/84

DESCRIPTION AND SOURCE OF SAMPLE :	Pasir Cimalaka	RECEIVED ON :	02-Mar-26
SAMPLE NO :			
TO BE USED FOR :	All Concrete Class		

		1	2	
1.	Weight of oven dry sample	500,0	500,0	gram
2.	Weight of washed & oven dry sample retained on 0.075 mm (No.200) sieve	477,0	486,0	gram
	Percentage of material finer than 0.075 mm ((No.200) sieve = $\frac{(1) - (2)}{(1)} \times 100\ \%$	4,60	2,80	%
	Average		3,7	%

Remark :

TESTED AND CALC. BY : Tri Raharjo DATE : 02-Mar-26

Lampirah Hasil Pengujian Gradasi Pasir Cimalaka.

SIEVE ANALYSIS FINE AGREGATE

(SNI-03-2834-2000)

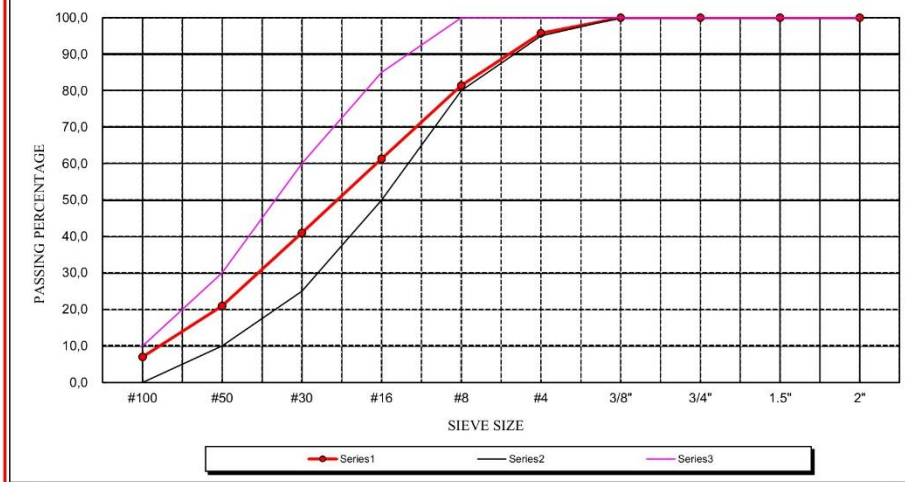
DESCRIPTION AND SOURCE OF SAMPLE : Pasir Cimalaka

RECEIVED ON 02/03/2026

TO BE USED FOR : *All Concrete Class*

TOTAL WEIGHT OF SAMPLE : 1000,0 Gram

SIEVE SIZE INCHES	RETAINED ON SIEVE GRAM	RETAINED ON SIEVE %	COMULATIVE RETAINED %	COMULATIVE PASSING %	GRADING SPECIFICATION ASTM C-33 %
2"					100 - 100
1.5"					100 - 100
3/4"					100 - 100
3/8"					100 - 100
#4	42,0	4,20	4,20	95,8	95 - 100
#8	144,0	14,40	18,60	81,4	80 - 100
#16	201,0	20,10	38,70	61,3	50 - 85
#30	203,0	20,30	59,00	41,0	25 - 60
#50	200,0	20,00	79,00	21,0	10 - 30
#100	140,0	14,00	93,00	7,0	0 - 10
PAN	70,0	7,00	100,00	0,0	*FM :* *2,93*



TESTED AND CALCULATION BY : Tri Raharjo **DATE : 02-Mar-26**

Lampiran Hasil Pengujian Berat Jenis Pasir Cimalaka.

SPECIFIC GRAVITY OF FINE AGGREGATE

ASTM C 128 - 84

DESCRIPTION AND SOURCE OF SAMPLE : **Pasir Cimalaka**

RECEIVED ON : **02-Mar-26**

TO BE USED FOR : *All Concrete Class*

			RUN NO. / NO.OF FLASK	I		II	
A	WEIGHT OF SSD SAMPLE ON AIR			**500,0**	*gram*	**500,0**	*gram*
B	WEIGHT OF FLASK			**174,0**	*gram*	**174,0**	*gram*
C	WEIGHT OF FLASK + WATER UP TO CALIBRATION MARK			**671,0**	*gram*	**671,0**	*gram*
D	WEIGHT OF FLASK + SSD MATERIAL + WATER UP TO CALIBRATION MARK			**979,0**	*gram*	**977,0**	*gram*
E	WEIGHT OF OVEN DRY SAMPLE			**473,0**	*gram*	**474,0**	*gram*
1	SPECIFIC GRAVITY	$\frac{A}{A + C - D}$		**2,60**		**2,58**	
	SSD BASIS				**2,59**		
2	SPECIFIC GRAVITY	$\frac{E}{A + C - D}$		**2,46**		**2,44**	
	OVEN DRY BASIS				**2,45**		
3	SPECIFIC GRAVITY	$\frac{E}{E + C - D}$		**2,87**		**2,82**	
	APPARENT				**2,84**		
4	WATER ABSORPTION	$\frac{A - E}{E} X\ 100\ \%$		**5,71**		**5,49**	
					5,60		

REMARK :

TESTED AND CALC. BY : **Tri Raharjo** **DATE :** **02-Mar-26**

Lampiran Kadar Hasil Pengujian Kadar Lumpur Agregat Kasar.

AMOUNT OF MATERIAL FINER THAN 0.075 MM

(ASTM C-117/84)

DESCRIPTION AND SOURCE OF SAMPLE : *Ex.Split Bangun Jaya, Purwakarta*

SAMPLE NO :

RECEIVED ON : *01-Mar-26*

TO BE USED FOR : *All Concrete Class*

1.	Weight of oven dry sample	***1000,0***	***1000,0***	gram
2.	|Weight of washed & oven dry sample |retained on 0.075 mm (No.200) sieve	***994,0***	***993,0***	gram
	|Percentage of material finer than |0.075 mm ((No.200) sieve = (1) - (2) X 100 % (1)	***0,60***	***0,70***	%
	Average	***0,65***		%

Remark :

TESTED AND CALCULATION BY : Tri raharjo DATE : 01-Mar-26

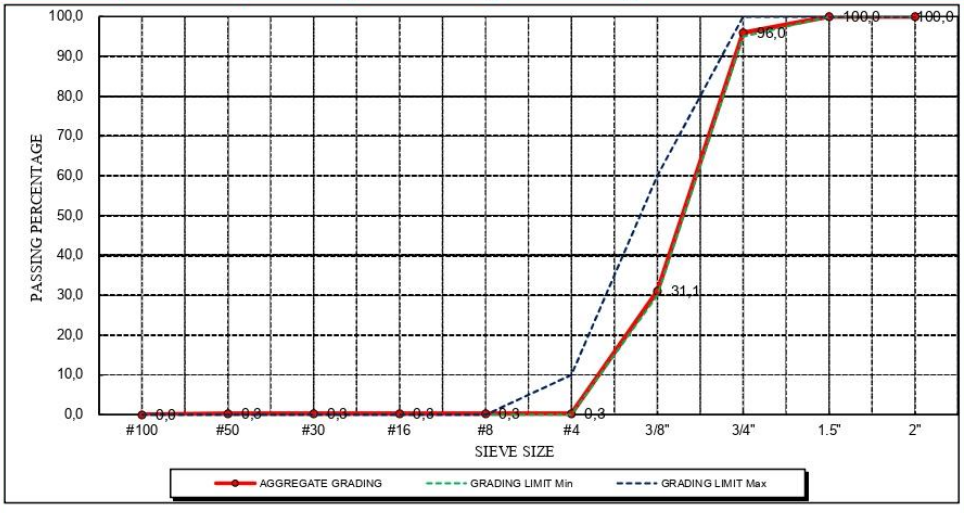
Lampiran Hasil Pengujian Gradasi Agregat Kasar.

SIEVE ANALYSIS OF COARSE AGGREGATE

(SNI-03-2834-2000)

DESCRIPTION AND SOURCE OF SAMPLE :	**Split 10 -20, Purwakarta**	**RECEIVED ON**	01-Mar-26
TO BE USED FOR :	*All Concrete Class*	**TOTAL WEIGHT OF SAMPLE :**	*5000,0* Gram

SIEVE SIZE INCHIES	RETAINED ON SIEVE GRAM	RETAINED ON SIEVE %	COMULATIVE RETAINED %	COMULATIVE PASSING %	GRADING SPECIFICATION SNI-03-2834-200 (MAX.20 MM) %
2"					*100 - 100*
1.5"					*100 - 100*
3/4"	201,0	4,0	4,0	96,0	*95 - 100*
3/8"	3245,0	64,9	68,9	31,1	*30 - 60*
#4	1541,0	30,8	99,7	0,3	*0 - 10*
#8	0,0	0,0	99,7	0,3	*0 - 0*
#16	0,0	0,0	99,7	0,3	*0 - 0*
#30	0,0	0,0	99,7	0,3	*0 - 0*
#50	0,0	0,0	99,7	0,3	*0 - 0*
#100	0,0	0,0	99,7	0,3	*0 - 0*
PAN	13,0	0,3	100,0	0,0	*FM : 6,71*



TESTED AND CALCULATION BY : Tri raharjo **DATE : 01-Mar-26**

Lampiran Hasil Pengujian Berat Jenis Agregat Kasar.

SPECIFIC GRAVITY OF COARSE AGGREGATE

ASTM C 127 - 84

DESCRIPTION AND SOURCE OF SAMPLE : *Ex.Split Bangun Jaya, Purwakarta*

RECEIVED ON : *01-Mar-26*

TO BE USED FOR : *All Concrete Class*

	RUN NO.		I	II
A	WEIGHT OF SSD SAMPLE ON AIR		***5000,0*** *gram*	***5000,0*** *gram*
B	WEIGHT OF SSD SAMPLE IN WATER		***3050,0*** *gram*	***3057,0*** *gram*
C	WEIGHT OF OVEN DRY SAMPLE		***4806,0*** *gram*	***4829,0*** *gram*
1	SPECIFIC GRAFITY SSD BASIS	A / A - B	***2,56***	***2,57***
				2,57
2	SPECIFIC GRAFITY OVEN DRY SAMPLE	C / A - B	***2,46***	***2,49***
				2,47
3	SPECIFIC GRAFITY APPARENT	C / C - B	***2,46***	***2,73***
				2,59
4	WATER ABSORPTION	(A - C) / C X 100 %	***4,04***	***3,54***
				3,79

Remark :

TESTED AND CALCULATION BY : Tri Raharjo

DATE : 01-Mar-26

Lampiran *Technical Data Sheet Admixture FBAS.*

TECHNICAL DATA SHEET

FLOBAS HPF-27

Super High Range Water Reducing Admixture (Type F)

PT. Flowric Bintang Adi Sentosa

Description

FLOBAS HPF-27 is a new progressive superplasticizer. It is a concentrated product, high water reduction with good slump retention, chloride-free, low alkali content, and high strength gain at early and long-term age. It can be widely used in a diverse range of concrete, in particular, it is suitable for Precast concrete. FLOBAS HPF-27 complies with ASTM C494-19, BS EN 934, JIS A 6204 -2011 and SNI 03-2945-1991, as High Range Water Reducing Admixture.

Principles of Function

Polycarboxylate which is developed by own technique and has a particular and unique structure is adsorbed on surface of cement particle momentarily and firmly. Hence efficiency of cement-dispersing is raised, it can produce fresh concrete with excellent workability, plasticity and lower thixotropy.

Technical Data

Form	Liquid
Appearance	Colorless to light yellowish
Specific Gravity	1.065 ± 0.02
pH	8 ± 2
Solid Contents	30.5 ± 2.0

Product Characteristic

1) Super High water reduction: The water reduction rate of concrete is above 40%

2) Ease of controlling production: Controlling water reduction ratio, plasticity and air entraining by adjusting molecular weight of main chain, length and density of side chain, type of side chain group.

3) High early strength gain: Greatly increase initial strength and long-term strength, reduce energy loss. Reduction of cracking, shrinkage and creep.

4) Good slump retention ability: Delaying time of transporting concrete and time of detention at construction site, guarantee concrete pumpability.

5) Good adhesion: Making concrete to have excellent workability, Non-layer,without segregation and bleeding.

6) Good dispersion: High fluidity of concrete results in deposing and compacting easily for self-compacting concrete.

7) Wide adaptability: It is compatible with ordinary silicate cement, silicate cement, slag silicate cement and all kinds of blendings for excellent dispersibility and plasticity.

8) Good strength and durability: Low alkali and chloride-ion content. Enhancing concrete strength and durability by densifying its internal structure.

9) Environmental friendly products: No pollution during production

FLOBAS HPF-27

TECHNICAL DATA SHEET

FLOBAS HPF-27

Super High Range Water Reducing Admixture (Type F)

PT. Flowric Bintang Adi Sentosa

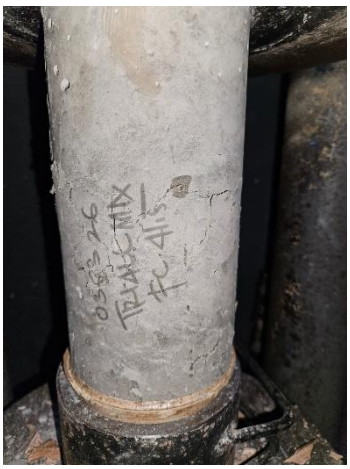
Methods of use	1) The recommended range of dosage of FLOBAS HPF-27 is suggested as follow (wt.% of cement): 0.6% - 1.5%. 2) It can be compounded together with retarder, defoamer, air-entraining agent, lignin-based admixture and so on.
Scope of Application	1) FLOBAS HPF-27 is a superplasticizer used in premix of construction and cast-in-place concrete. 2) It is especially suitable for high strength concrete such as railway, haven, traffic, bridge and electric power and so on. 3) It is suitable for the preparation of high strength, high durability, self-compacting, steel fiber and self-leveling concrete.
Package & Storage	1) Liquid product: 200L drum or 1000L IBC tank. 2) Stored under 0-35°C, far away from sunlight 3) Shelf life is normally six month.
Handling Notes	1) FLOBAS HPF-27 is free from alkaline. It is non toxic, non hazardous, and non corrosive. 2) When it contacts eyes and skin, The affected area shall be immediately rinsed with plenty of water for several minutes. Consult physician if irritation persists. 3) Keep container closed when it is not in use. Do not store the product directly under sunlight.

Lampiran Hasil Pengujian Kuat Tekan Beton Umur 28 Hari

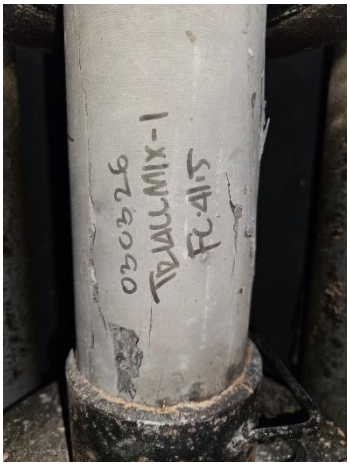
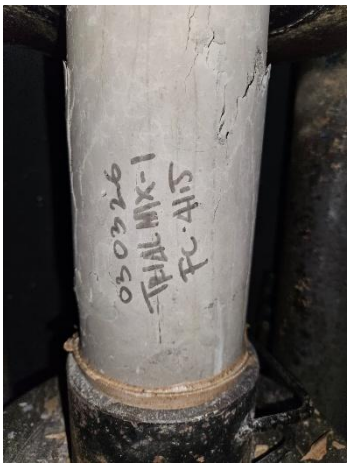
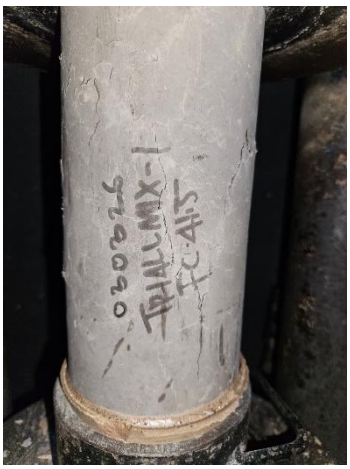
No.	Tanggal Pembuatan	Tanggal Test	Umur *(day)*	*Slump* (cm)	Kode Benda Uji	Berat (kg)	Ukuran Benda Uji		Luas Penampang (cm)	Beban (kn)	Kuat Tekan (MPa)	Kuat Tekan Kubus (kg/cm^2)
							Dia./Ø (cm)	*High* (cm)				
1	03/03/26	31/03/26	28	12	TR-MIX /Fc 41,5	3,57	10	20	78,54	327,0	41,63	501,56
2	03/03/26	31/03/26	28	12	TR-MIX /Fc 41,5	3,57	10	20	78,54	330,8	42,12	507,46
3	03/03/26	31/03/26	28	12	TR-MIX /Fc 41,5	3,58	10	20	78,54	334,3	42,57	512,89
									Jumlah rata – rata :	**330,7**	**42,1**	**507,3**
1	03/03/26	31/03/26	28	16	TR-MIX-I /Fc 41,5	3,61	10	20	78,54	372,4	47,42	571,32
2	03/03/26	31/03/26	28	16	TR-MIX-I /Fc 41,5	3,59	10	20	78,54	362,8	46,19	556,50
3	03/03/26	31/03/26	28	16	TR-MIX-I /Fc 41,5	3,63	10	20	78,54	369,8	47,08	567,22
									Jumlah rata – rata:	**368,33**	**46,89**	**565,01**
1	03/03/26	31/03/26	28	16	TR-MIX-II /Fc 41,5	3,68	10	20	78,54	385,9	49,14	592,77
2	03/03/26	31/03/26	28	16	TR-MIX-II /Fc 41,5	3,67	10	20	78,54	393,0	50,03	602,77
3	03/03/26	31/03/26	28	16	TR-MIX-II /Fc 41,5	3,70	10	20	78,54	387,1	49,29	593,85
									Jumlah rata – rata:	**388,66**	**49,50**	**596,46**
1	03/03/26	31/03/26	28	16,5	TR-MIX-III /Fc 41,5	3,69	10	20	78,54	381,5	48,58	585,30
2	03/03/26	31/03/26	28	16,5	TR-MIX-III /Fc 41,5	3,71	10	20	78,54	372,7	47,46	571,80
3	03/03/26	31/03/26	28	16,5	TR-MIX-III /Fc 41,5	3,67	10	20	78,54	386,8	49,25	593,37
									Jumlah rata – rata:	**380,33**	**48,43**	**583,49**

Sumber: Hasil Pengujian PT.AdhimixPrecast, 2026

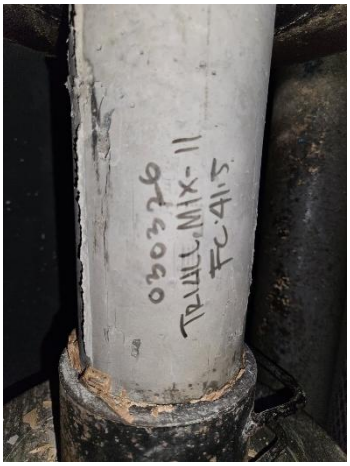
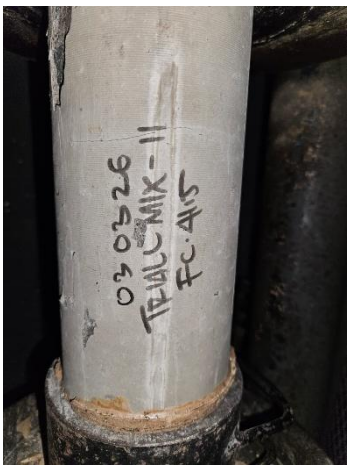
Lampiran Hasil Pengujian Kuat Tekan Beton Normal Umur 28 hari.

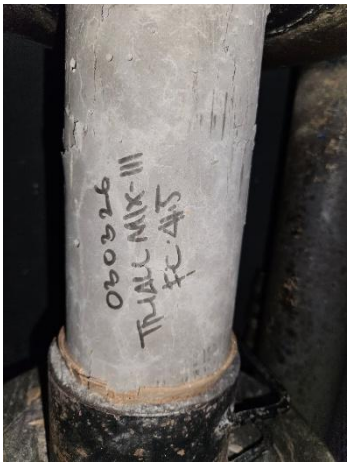
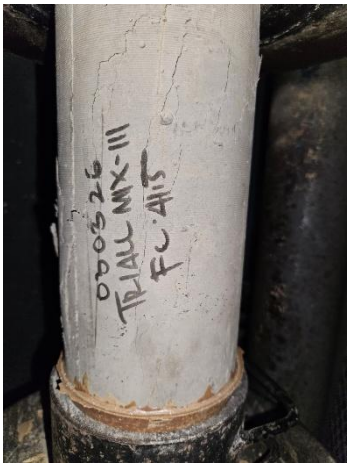
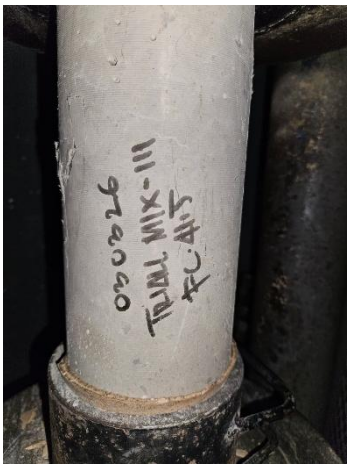
Lampiran Hasil Pengujian Kuat Tekan Beton *Polycarboxylate* 0,6% Umur 28 hari.

Lampiran Hasil Pengujian Kuat Tekan Beton *Polycarboxylate* 0,8% 28 hari.

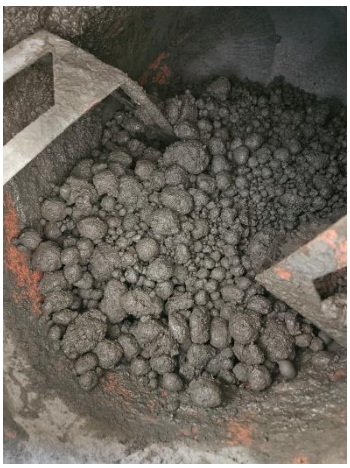
Lampiran Hasil Pengujian Kuat Tekan Beton *Polycarboxylate* 1% 28 hari.

Lampiran Dokumentasi Penelitian, 2026.

Lampiran Dokumentasi Penelitian, 2026.

Lampiran Dokumentasi Penelitian, 2026.