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INFLUENCE OF DIFFERENT CPJ35 AND 32.5 CEMENT BRANDS (CIMAF, CIMENCAM – MULTI X) ON THE COMPRESSIVE STRENGTH OF HARDENED CONCRETE IN CAMEROON

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ABSTRACT

Cement is a hydraulic binder composed of finely ground powdered materials that, when mixed with water, form a more or less plastic paste capable of binding various substances as it hardens. This study, titled "**Influence of CPJ35 and 32.5 (CIMAF, CIMENCAM – MULTI X) Cements on the Compressive Strength of Hardened Concrete,**" aims to conduct a detailed investigation into how these types of cement affect the compressive strength of hardened concrete at different curing ages. To achieve this objective, various laboratory tests were carried out, including particle size analysis, material density measurements, concrete mix design, and compressive strength testing of the specimens. Through multiple destructive test series using a hydraulic press, results were obtained at different curing intervals.

The results indicate that concrete made with CEM II 32.5R cement, which sets and hardens more rapidly, exhibits higher compressive strength than concrete made with CPJ35 cement—both at early ages and over the full curing process. For example, at 28 days, with the same cement dosage and under identical curing conditions (submersion), we recorded an average compressive strength of 24.10 MPa for concrete made with Multi-X CEM II 32.5R, compared to 22.97 MPa for concrete made with CPJ35 cement. These results suggest that Multi-X cement is recommended for constructing various types of structures, including structural elements that must bear loads both in the short and long term. However, CIMAF CPJ35 cement is more suitable for ready-mix concrete (RMC), as it has a slower setting rate than CEM II 32.5R.

Keywords: Concrete, Cement, Strength, Aggregates

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INTRODUCTION

Concrete is the most widely used material in the construction industry due to its economic and technical advantages. The balance it offers between mechanical strength, cost, aesthetics, and ease of application has secured its place as the leading construction material globally. The mechanical strength of hardened concrete depends on the mix proportions, strength class, and even the type of cement used in the mix. Since cement serves as the binder for aggregates when water is added, the load-bearing capacity of hardened concrete depends on numerous factors such as aggregate type and size, water-to-cement ratio (w/c), cement content, mixing water quality, and more. Concrete hardening involves transitioning from a plastic to a hardened state. This is a result of chemical reactions between the mixing water and cement particles—known as the hydration reaction of Portland cement. Given the wide range of cement classes used sometimes without proper control, especially in large-scale projects, detailed studies are necessary to prevent structural failures. In this context, our objective is to compare the mechanical performance of concrete made with CPJ35 and 32.5 cements at various ages, with a focus on identifying which type provides better compressive strength at 28 days. According to standard NT 47-01 (NF EN 197-1), cement is a powdered material composed of about 80% clinker that, when mixed with water or a saline solution, forms a binding plastic paste capable of hardening and agglomerating various materials. Clinker is typically composed of a raw mix consisting of 80% limestone ($CaCO_3$) and 20% clay (silico-aluminate). Cement paste, consisting of cement, water, air, additives, and admixtures, acts as both a binder and filler in concrete. It governs flow behavior through a rheological process primarily linked to viscosity (Nguyen T.L.H, 2007).

LITERATURE REVIEW

Influence of the Water/Cement Ratio

Didier Fokwa (1992) experimentally demonstrated that the characteristic length of concrete ranges between four to six times the size of the largest aggregate used. However, this does not apply to mortars, for which the largest aggregate size is likely not the greatest heterogeneity. Peak stress and energy density at fracture decrease with increasing aggregate size, although the total fracture energy increases. Fokwa also proposed a hierarchical model accounting for the heterogeneous nature of concrete microstructure.

N. Bouhamou (2009) examined the influence of mix design parameters on the behavior of Self-Compacting Concrete (SCC) in both fresh and hardened states. The study explored the effects of water-to-cement and fines-to-cement ratios, through tests including slump flow, L-box, sieve stability, bleeding, mechanical strength, free shrinkage (drying and autogenous), and microstructural analysis (mineralogical characterization, pore size distribution). The results highlight the critical role of the pore network and hydrate microstructure.

Pierre Mounanga (2003) studied the evolution of autogenous shrinkage and thermal conductivity of cement pastes with low w/c ratios (0.25 to 0.40) and under different isothermal curing temperatures (10°C to 50°C). Results showed minimal variation in thermal properties across the examined temperature and w/c ranges.

Xuan Hong Vu (2009) conducted an experimental study on the influence of saturation levels and water/cement ratios on the behavior of concrete under high confinement—useful in situations involving close-range explosions or ballistic impacts. The results showed that load capacity increases with confinement pressure in dry concrete, whereas it remains limited in wet or saturated concrete beyond a certain pressure.

Cement Concrete for Roadworks

J. Alexandre et al. (1980), in their first publication (Fascicle N°21), provided a general description of concrete pavement structures and construction processes, covering site preparation, material selection (cement, aggregates, water, admixtures), and mix design. The second part (Fascicle N°22) dealt with concrete production, placement, and road construction techniques.

P. LONGUET (1983) emphasized the complexity of hardened cement concrete behavior and the difficulty in determining an exact cement content. The most common approach involves mild acid attack on hardened concrete to selectively dissolve both anhydrous and hydrated cement components. Since calcium silicates are the essential cement phases, the soluble silica content is often used to estimate cement content. Longuet also highlighted the disruptive influence of acids from cement type, aggregate nature, and aging conditions. Additionally, he demonstrated that carbonation rate, even in calcareous concrete, can help estimate cement content.

Conclusion from the Literature Review

This literature review confirms that cement acts as the primary binder between aggregates in concrete. Therefore, the compressive strength—i.e., the ability of hardened concrete to withstand applied loads—depends on several parameters, including aggregate type and size, water/cement ratio, cement content, quality of mixing water, and more.

MATERIALS AND METHODS

In order to highlight the influence of CPJ35 and 32.5 (CIMAF, CIMENCAM – MULTI X) cement types on the compressive strength of hardened concrete available on the Cameroonian market and produced locally, an appropriate methodology must be applied to ensure proper execution of laboratory work and accurate calculation of the various parameters involved in concrete composition.

FIELD WORK

This phase consisted in sourcing the different materials according to their origin.

Materials Used

Several materials were employed:

- River sand (0/5 mm);
- Crushed gravel (5/15 mm);
- CIMAF CPJ 35 cement;
- MULTI-X CEM II 32.5 R cement ;
- Potable water.

Nature and Origin

With the aim of promoting local materials, all the materials used in this research were sourced locally (within Cameroon).

Table 1 shows the nature and origin of the various materials used.

Table 1: Nature and Origin of Materials

MATERIALS	NATURE	ORIGIN	SPECIFICATIONS
Sand	river / rolled sand	Sanaga (Ebebda – Cameroun)	0 /5
Gravel	quarry /crushed	Tchipou - Bamoungoum	5 /15
Cement	CPJ 35	CIMAF (Douala – Cameroun)	NC 234 : 3009-6
	CPJ CEM II 32.5 R	(Multi-X)/CIMENCAM (Douala – Cameroun)	
Water	Portable water	CDE	Tap water

Figure 1 : Differents brand of cements studied

Figure 2 : sand and gravel

LABORATORY WORK

All material testing (sand, gravel, cement, and concrete) was conducted at the Materials and Geotechnical Laboratory of the Fotso Victor University Institute of Technology in Bandjoun.

Experimental Methodology

The study followed a purely experimental approach, involving the preparation of specimens and characterization of materials based on the following properties:

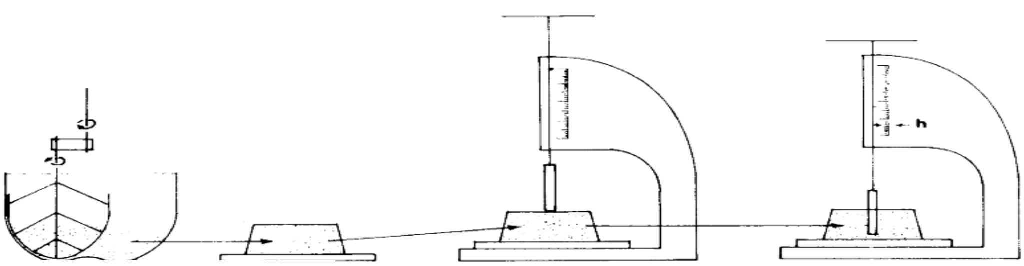
- Physical properties: moisture content, bulk density, specific gravity, absorption rate, sand cleanliness, and optimal compaction density.
- Geometrical properties: particle size distribution, fineness modulus, flakiness index, and slump value.
- Mechanical property: compressive strength testing.

Cement Testing

Consistency Test

This test determines the water-to-cement (W/C) ratio that yields a standard consistency paste — neither too stiff nor too fluid. It is conducted using a Vicat apparatus equipped with a 10 mm diameter plunger and a 300 g weight.

Standard consistency is achieved when the needle penetrates to a depth of 6 ± 1 mm from the bottom of the mold within 30 seconds of release.



Mixing of the Sample

Penalty of the Probe

Figure 3 : Diagram of the consistency test principle

Test procedure:

- Adjust the Vicat apparatus by lowering the needle until it touches the flat base plate, then align the pointer with the zero mark on the scale.
- Raise the needle to the standby position.
- Thoroughly clean and dry all tools (mixer, bowl, etc.).
- Pour the selected amount of water (based on W/C ratio) into the mixing bowl.
- Add 500 g of cement within 5 to 10 seconds.
- Record the end of this step as zero time.
- Start the mixer at low speed for 90 seconds.
- Stop the mixer and scrape the sides of the bowl with the paddle for 15 seconds.
- Resume mixing for another 90 seconds at low speed.
- Quickly place the paste into a clean, dry, truncated cone mold placed on a flat glass plate — avoid excessive compaction.
- Position the mold under the Vicat needle, align the needle flush with the top of the mold, and lock it.
- Four minutes after zero time, release the needle into the paste and, after 30 seconds, measure the depth d between the needle tip and the base plate.
- Repeat the procedure, adjusting the W/C ratio, until a penetration of $d = 6 \pm 1$ mm is achieved.
- Plot a curve of penetration depth (d) versus W/C ratio to determine the optimal value.

Concrete Testing Procedures

Initial Setting Procedure

- Raise the needle to the standby position.
- Prepare the paste using the optimal water content determined from the consistency test.
- Quickly place the paste into the truncated cone mold without excessive compaction, on a flat glass plate.
- Align the mold under the Vicat needle, lower it flush with the top, and lock it.
- Drop the needle; record this as zero time. After 30 seconds, note the penetration depth.
- Clean the needle after each penetration.
- Place the mold and plate into a water bath at 20°C (or control room temperature at 20°C).
- Repeat the depth measurement every 10 minutes until it reaches 4 ± 1 mm.
- Record the initial setting time from zero.
- Track temperature changes every 10 minutes using a second sample.

Note: For repeated tests, maintain 10 mm spacing between needle points.

- ➢ Final Setting Procedure
- Invert the filled mold onto the glass base plate.
- Attach the ring accessory to the needle. 4
- Center the inverted mold under the Vicat apparatus.
- Adjust the needle to just touch the paste surface.
- Release the needle.
- Observe the ring trace: final setting is reached when no visible trace remains.
- Place the mold in a water bath at 20°C.

- Clean the needle after each reading at 10–20 minute intervals.
- Record final setting time from zero.
- Empty, clean, and discard the mold.

Concrete Mix Design

Concrete formulation helps determine material quantities per cubic meter based on workability and strength defined by project specifications. It also provides parameters for handling, short-term performance, and durability.

Key factors include:

- Workability
- Target strength
- Cement type and dosage
- Aggregate type and density

The Dreux-Gorisse method was used to calculate optimal mix ratios in compliance with standards:

- Determination of water-to-cement ratio
- Cement and water dosage
- Mix with minimum void ratio
- Concrete compactness
- Specific gravity of aggregates
- Final mix proportions.

Fresh Concrete Testing: Slump Test

Concrete's moldability requires sufficient workability for proper placement and reinforcement coverage.

Workability is evaluated via the slump test.

Procedure:

- Place a slightly damp mold on a horizontal surface.

- Fill it in three equal layers, each tamped 25 times.

- Level the top, clean the base area, and lift the mold vertically within 5–10 seconds.

- Measure slump to the nearest 10 mm.

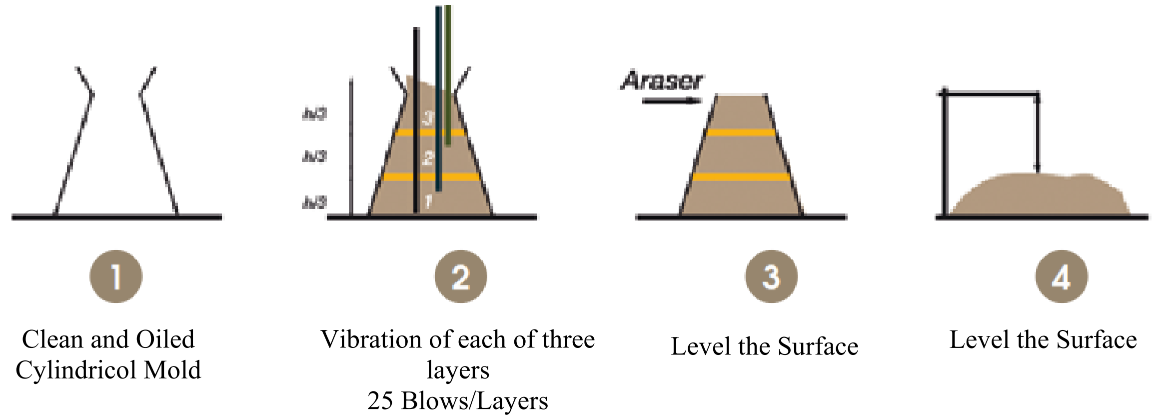


Figure 4 : Steps of the slump test procedure.

Fresh Concrete Density
After achieving the desired slump:

- Clean, oil, and tighten a 16×32 cm cylindrical mold.

- Weigh the empty mold (M1).

- Fill it in three layers, vibrating each.

- Level and clean the mold.

- Weigh the filled mold (M2).

- Density = (M2 - M1) / volume of mold.

Hardened Concrete Testing
Concrete is placed in layers: 3 for 160×320 mm cylinders, 2 for 110×220 mm and 150 mm cubes, 1 for 100 mm cubes.

Specimens remain in molds for at least 16 hours and up to 2 days (3 on weekends/holidays) at 20°C ±5°C.

If ambient temp <15°C, use an insulated box (9 specimens max).

Transport specimens carefully to avoid drying or shocks.

Within 3 hours of demolding, store them in water or a 20°C ±2°C room at >95% relative humidity.

Compression Strength Test
Specimens are tested to failure in a compression machine. Peak load determines compressive strength, accurate to 0.5 MPa.

Procedure:

- Center the surfaced specimen between the machine plates.

- If unsurfaced, use shims (wood boards, sandboxes).

- Close safety door and release valve.
- Start the machine.
- Turn load valve to maximum until contact is made.
- Reduce loading speed by ~12 turns.
- Apply load until failure. Record maximum load (Fc).
- Once fractured, reduce load rate and release pressure.
- Stop the machine.

Compressive strength Rc (in kN/m²) is calculated using contact area S.

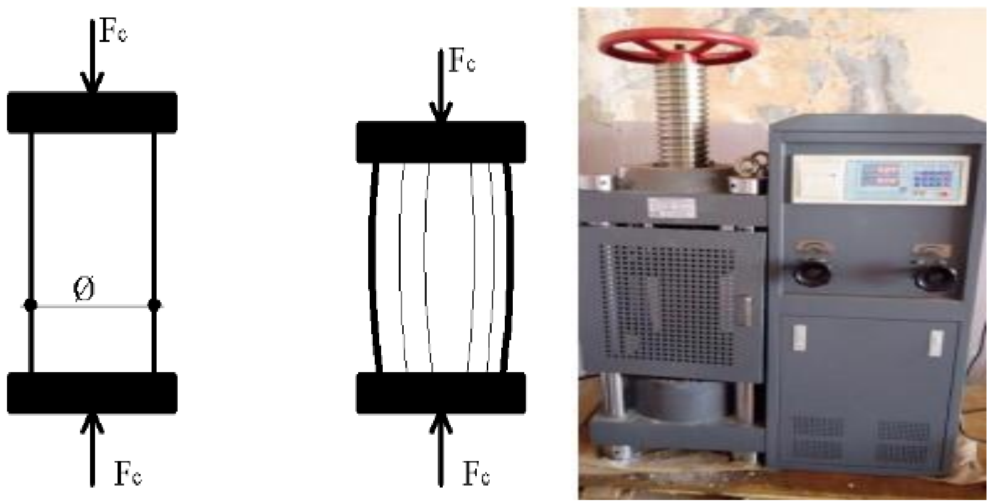


Figure 5 : Compression test setup.

Water Absorption of Specimens

This test allows us to understand the behavior of concrete when exposed to water. It therefore consists in determining the amount of water absorbed by normal concrete over time. The specimens are placed in an oven for 48 hours after demolding, then weighed to record the dry mass (M_d). They are then immersed in water for 24 hours and weighed again to obtain the wet mass (M_w).

$$A_b(\%) = \frac{M_w - M_d}{M_d} \times 100$$

RESULTS AND DISCUSSION

Results

Densities are essential data for characterizing a material. The most important of all is the specific density, which represents the true density of the material. In our work, the values obtained are recorded in the following table:

Table 2 : Density of Materials Used in Concrete Mix Design

Material	Specific density	Temperature (°C)	Correction Coefficient as a function of temperature	Corrected Density	Verification
Sand	2.65	25	0.008	2.67	2≤ρground≤ 3
Gravel	2.7	25	0.008	2.72	
MULTI-X cement	2.92	25	0.008	2.94	2,9≤ρcement≤ 3
CIMAF cement	2.9	25	0.008	2.92	

Cement Consistency Tests

A 360 g sample was taken for each cement type, E1 and E2, corresponding respectively to CIMAF and MULTI-X.

After several trials with initial water quantities based on a water-to-cement (W/C) ratio of 0.28, we obtained the following results:

Table 3 : Consistency Test Results of the Different Cements

CIMAF CPJ35		MULTI-X 32.5R	
W/C	d in mm	W/C	d in mm
0.28	13	0.28	12
0.29	11	0.29	9
0.30	8	0.30	7
0.31	7	0.31	5
0.32	5.5		

Cement Setting Tests

Following the consistency test mentioned above, 360 g of cement was again taken for the setting time test (initial and final setting times). This cement mass was hydrated using the optimal W/C ratios found during the consistency test: 31.6% and 30.5% respectively for CIMAF CPJ35 and MULTI-X 32.5R. The test was then carried out, and the results are shown in the following setting evolution curves:

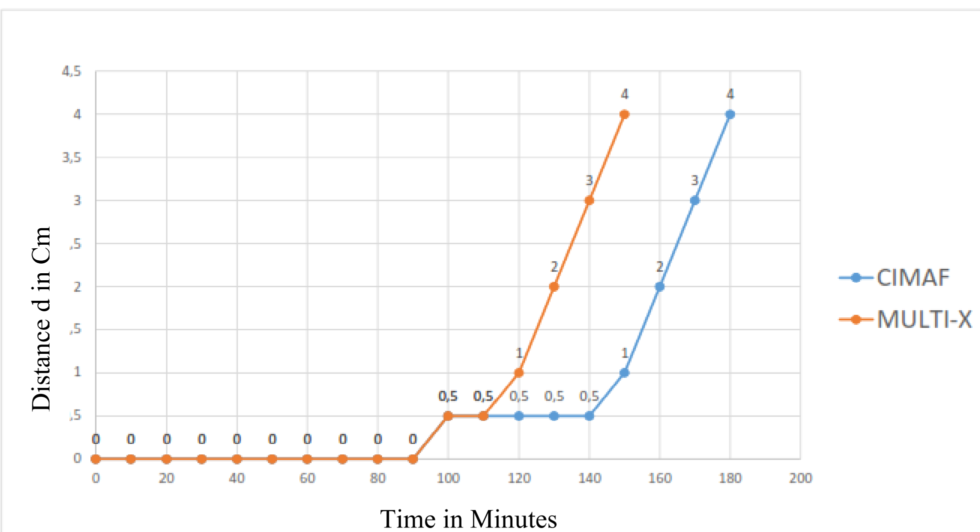


Figure 6 : Evolution Curves of Taking Time of different Cements Brand

Concrete Mix Design

For concrete formulation, it is always essential to know the specific density of each component of the concrete mix. This parameter is used to calculate the mix proportions of sand, gravel, cement, and mixing water, based on the compactness coefficient of the aggregates, according to the Dreux-Gorisse method. The results, depending on the cement type, are summarized in the tables below:

Table 4 : Concrete Mix Composition with CIMAF CPJ35 Cement

MATERIAL	Corrected compactness coefficient	Absolute volume	Density	Dosage in kg/m^3
CIMAF CPJ35	0.805	119.86	2.92	350
Gravel		397.38	2.72	1092.79
Sand		287.76	2.67	719.39
Water		/	/	189.61
TOTAL				**2351.80**

Table 5 : Concrete Mix Composition with MULTI-X 32.5 Cement

MATERIAUX	Corrected compactness coefficient	Absolute volume	Density	Dosage in kg/m^3
MULTI-X 32,5 cement	0.805	119.05	2.94	350
Gravel		397.85	2.72	1094.09
Sand		288.10	2.67	720.25
water		/	/	189.61
TOTAL				**2353.95**

Slump Test (Abrams Cone)

The Abrams cone slump value allows us to characterize the workability of fresh concrete. This value is determined during the slump test, which is conducted immediately after concrete mixing. This test also helps verify whether the actual slump corresponds to the theoretical value targeted in the mix design, which in our case was 8 cm (plastic concrete). After several trials, the results obtained are shown in the table below, followed by the corresponding bar charts:

Table 6 : Measured Slump Values (S)

	MULTI-X 32.5R	CIMAF CPJ35
S_1	8	8.7
S_2	7.8	8.3
S_3	7.6	9
Average ''S''	**7.80**	**8.67**

Bulk Density

The bulk density also provides insights into the mechanical behavior of concrete. The apparent density of the freshly prepared concrete was determined by weighing the specimens immediately after demolding. The results obtained are shown in the following tables:

❖ CIMAF CPJ35

Table 7 : Bulk Density of CIMAF Specimens after Demolding

Sample	Mass	Volume	Density
S1	15.2	**0.00643**	2363.92
S2	15.1		2348.37
S3	15.3		2379.47
Average	**15.2**		**2363.92**

❖ MULTI-X 32.5R

Table 8 : Bulk Density of MULTI-X Specimens after Demolding

Samples	Mass	Volume	Density
S1	15.2	**0.00643**	2363.92
S2	15.4		2395.02
S3	15.2		2363.92
Average	**15.27**		**2374.29**

Compressive Strength Tests

Compressive strength tests on the various cylindrical specimens were carried out at different curing periods, namely: day 3, day 14, day 21, and day 28.

❖ *Crushing at 3 days*

Table 9 : Compressive Strength of CIMAF CPJ35 Concrete at 3 Days

Mold	Specimens	Mass (kg)	Days	Fc (KN)	Rc_3 (MPa)
Cylindrical Cylindrique	S_1	15.2	After 3 days	188.5	9.38
	S_2	15.4		191.64	9.54
	S_3	15.5		197.85	9.85
Average compressive strength					**9.59**

Table 10 : Compressive Strength of MULTI-X 32.5 Concrete at 3 Days

Mold	Specimens	Mass (kg)	Days	Fc (KN)	Rc_3 (MPa)
Cylindrical	S_1	15.7	After 3 days	257.99	12.84
	S_2	15.4		234.52	11.67
	S_3	15.5		246.71	12.28
Average compressive strength					**12.27**

❖ Crushing at 14 days

Table 11 : Compressive Strength of CIMAF CPJ35 Concrete at 14 Days

Mold	Specimens	Mass (kg)	Days	Fc (KN)	Rc 3 (MPa)
Cylindrical	S1	15.4	After 14 days	358.36	17.84
	S2	15.55		370.58	18.45
	S3	15.3		350.71	17.46
Average compressive strength					**17,91**

Table 12 : Compressive Strength of MULTI-X 32.5 Concrete at 14 Days

Mold	Specimens	Mass (kg)	Days	Fc (KN)	Rc 3 (MPa)
Cylindrical	S1	15.4	After 14 days	378.95	18.86
	S2	15.7		409.32	20.37
	S3	15.6		390.23	19.42
Average compressive strength					**19.55**

❖ Crushing at 21 days

Table 13 : Compressive Strength of CIMAF CPJ35 Concrete at 21 Days

Mold	Specimens	Mass (kg)	Days	Fc (KN)	Rc 3 (MPa)
Cylindrical	S1	15.2	After 21days	405.69	20.19
	S2	15.5		445.98	22.20
	S3	15.4		438.54	21.83
Average compressive strength					**21.41**

Table 14 : Compressive Strength of MULTI-X 32.5 Concrete at 21 Days

Mold	Specimens	Mass (kg)	days	Fc (KN)	Rc 3 (MPa)
Cylindrical	S1	15,3	After 21 days	411,3	20,47
	S2	15,6		465,98	23,19
	S3	15,5		449,32	22,37
Average compressive strength					**22,01**

❖ Crushing at 28 days

Table 15 : Compressive Strength of CIMAF CPJ35 Concrete at 28 Days

Mold	Specimens	Mass (kg)	Days	Fc (KN)	Rc 3 (MPa)
Cylindrical	S1	15.3	After 28 days	461.12	22.95
	S2	15.15		452.34	22.52
	S3	15.4		471.08	23.45
Average compressive strength					**22.97**

Table 16 : Compressive Strength of MULTI-X 32.5 Concrete at 28 Days

Mold	Specimens	Mass (kg)	Days	Fc (KN)	Rc 3 (MPa)
Cylindrical	S1	15.4	After28 days	485.32	24.16
	S2	15.3		475.51	23.67
	S3	15.5		491.69	24.47
Average compressive strength					**24.10**

Discussion

It can be observed that the materials used comply with standard requirements for conventional concrete. From the results, we can see that the lightest cement is:

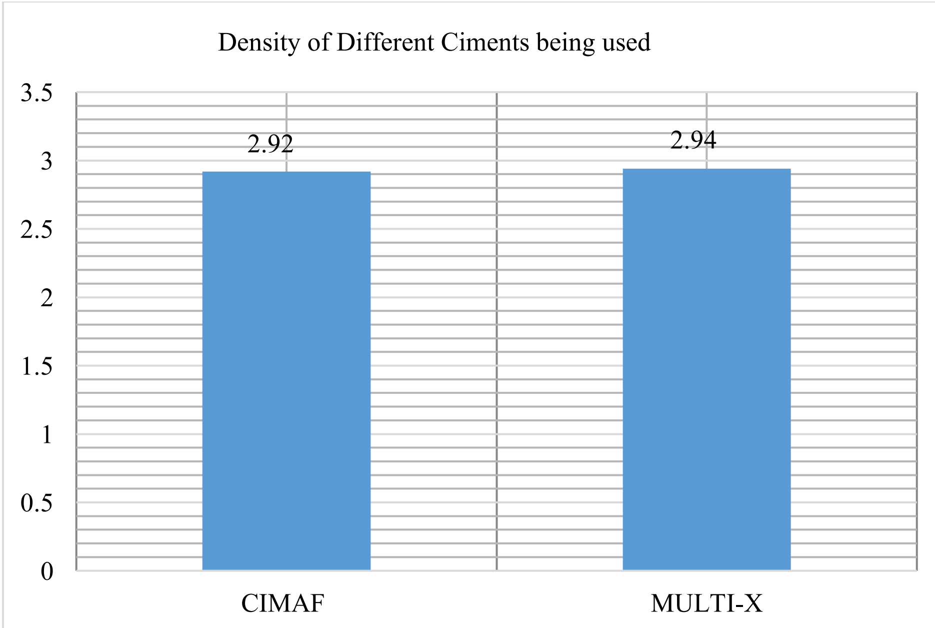


Figure 7 : Cement Density Diagram

From this diagram, we can observe that CIMAF CPJ35 is the lightest cement, while MULTI-X 32.5R is the densest.

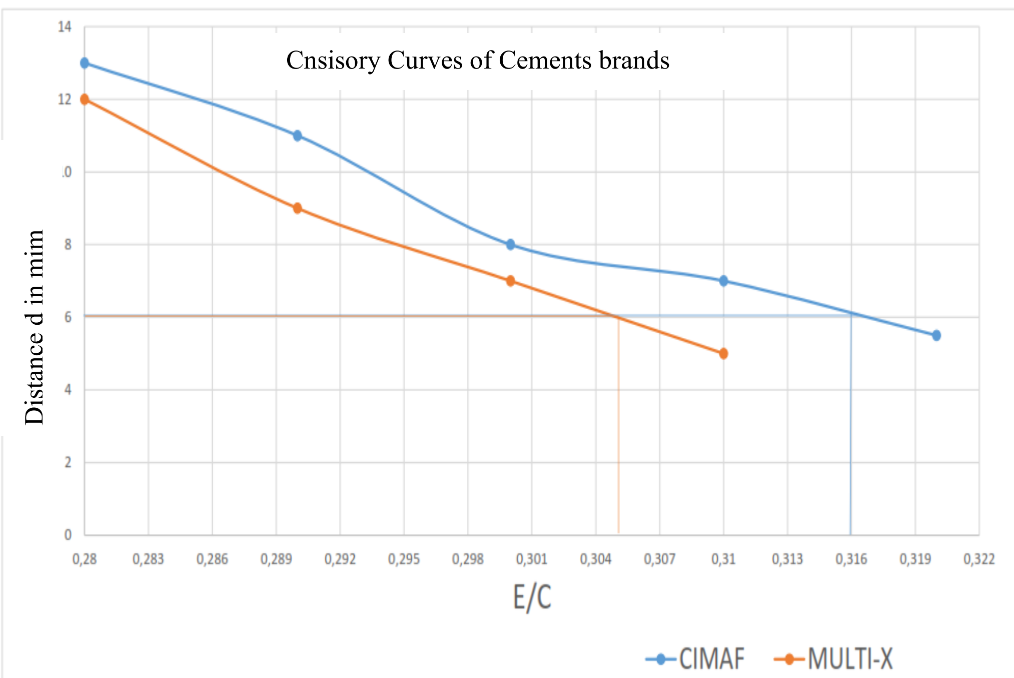


Figure 8 : Consistency Evolution Curve of the Cements

From these two curves, it appears that the cements reached optimal consistency at the following ratios:

- W/C = 0.316 for CIMAF CPJ35: this means the water required for optimal hydration is 31.6% of the cement mass used.

❖ W/C = 0.305 for MULTI-X 32.5R: the required water is therefore 30.5% of the cement mass used.

From the setting time tests and the curves obtained above, we observe that initial setting began:

- 180 minutes after mixing (i.e. 3h00, from 2:20 PM to 5:20 PM) for CIMAF CPJ35
- 150 minutes after mixing (i.e. 2h30, from 2:00 PM to 4:30 PM) for MULTI-X 32.5R, which is 30 minutes earlier than CIMAF CPJ35

Immediately following the initial setting, the final setting test was conducted. The results show that:

- For CIMAF CPJ35, final setting occurred at 5:50 PM, i.e. 30 minutes after initial setting, or 3h50 after mixing
- For MULTI-X 32.5R, final setting occurred at 5:20 PM, i.e. 50 minutes after initial setting, or 3h20 after mixing.

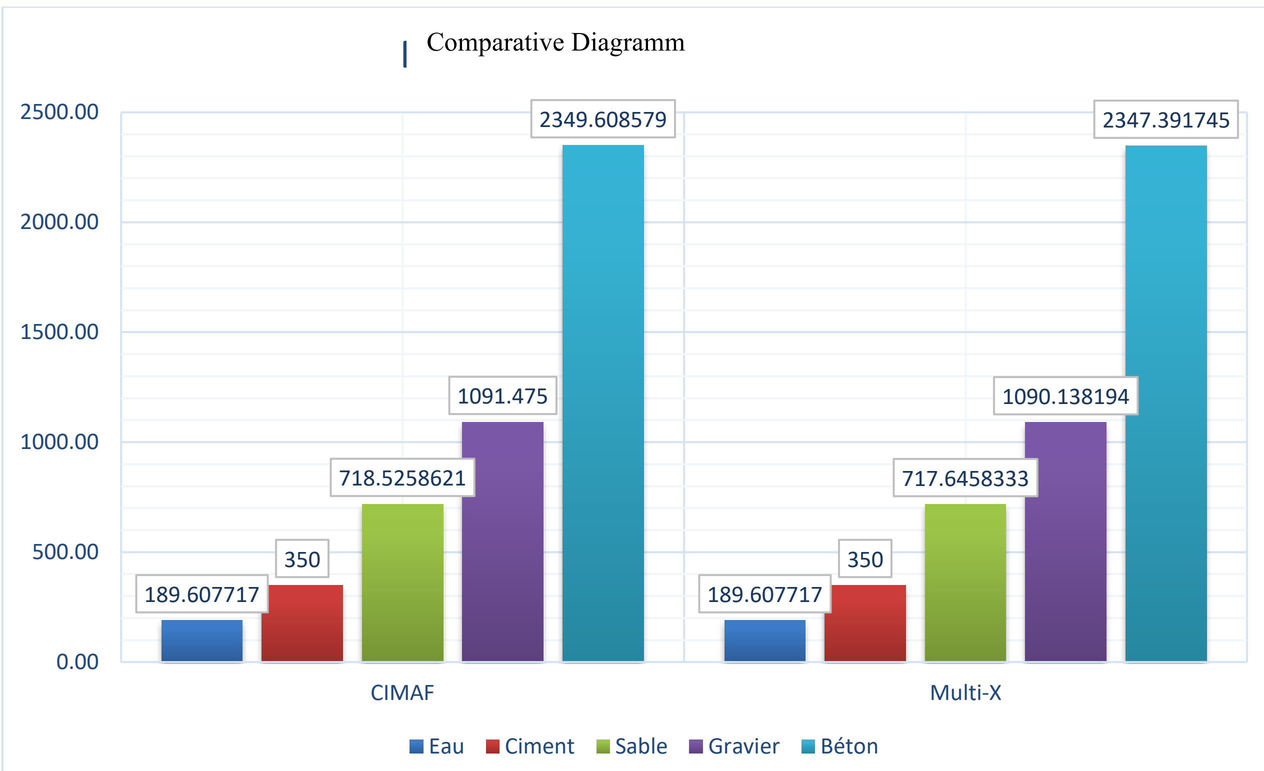


Figure 9 : Comparative chart of the various constituents in Kg in the concrete mix

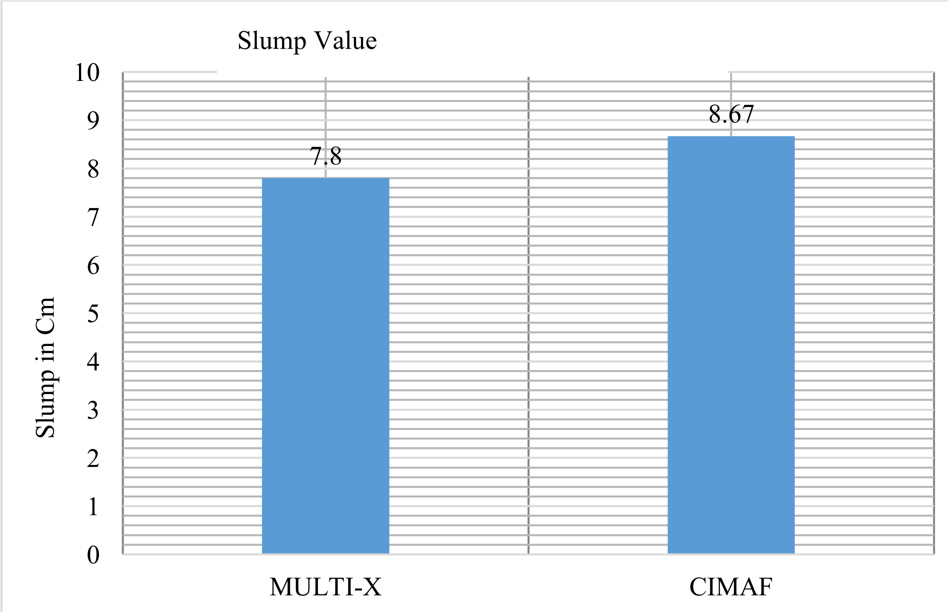


Figure 10 : Slump Test Results Using the Abrams Cone

Following these tests, we observed that although both concrete mixes received the same amount of water, there is a slight difference in slump values. The slump of the concrete made with Multi X 32.5R cement is slightly lower than that of the concrete made with CIMAF CPJ35 cement. However, it is worth noting that:

These slump values are very close to the projected value (8 cm), These results confirm that both concretes fall within the same target consistency class (Class S2 – Plastic Concrete).

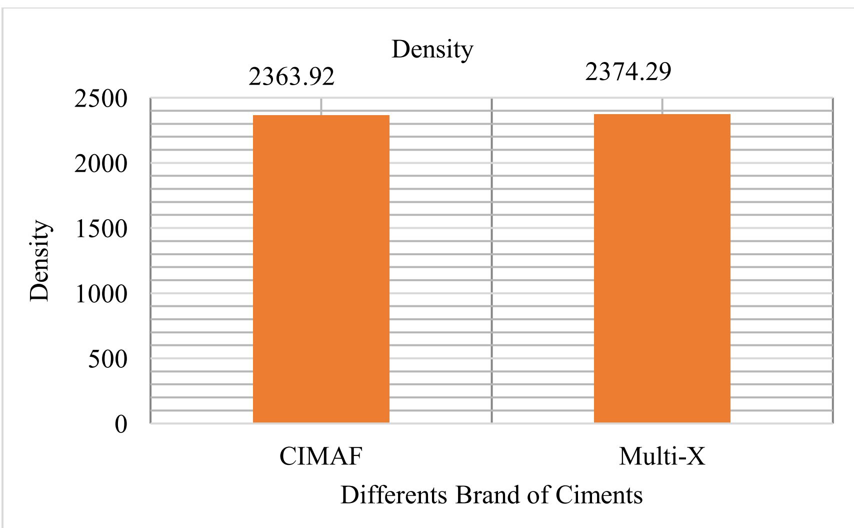


Figure 11 : Histogram of Concrete Densities After Demolding

From the results obtained, we observed that the apparent density of the concrete made with Multi-X cement is consistently higher than that of the concrete made with CIMAF cement. This also explains the superior mechanical performance of the Multi-X-based concrete at various curing ages compared to that made with CIMAF.

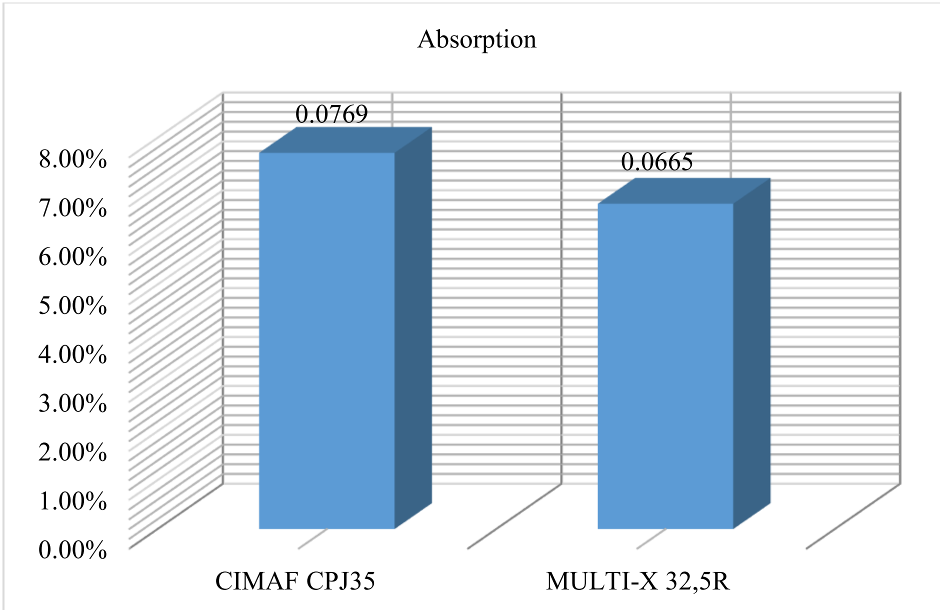


Figure 12 : Water Absorption According to Cement Type

This characteristic is particularly relevant for understanding how the two concretes behave in the presence of water. After testing, we found that the specimen made with CIMAF cement absorbed more water during the soaking phase compared to the Multi-X cement. This higher absorption is due to the presence of excess pores in the hardened concrete.

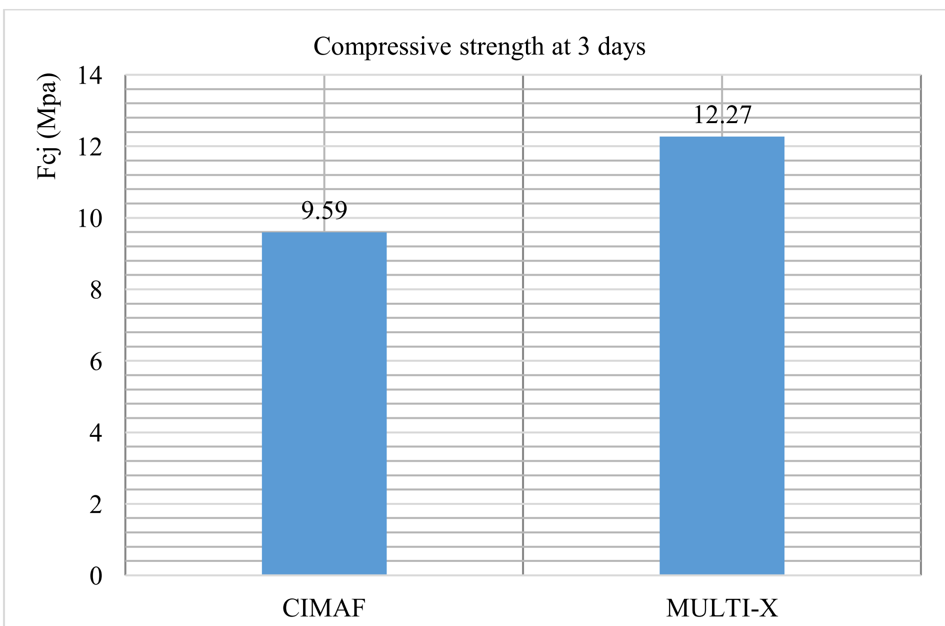


Figure 13 : Compressive Strength at 3 Days

At 3 days, the compressive strength of the Multi-X cement is already beyond the expected value and is significantly higher than that of the CIMAF cement, with a difference of 2.68 MPa.

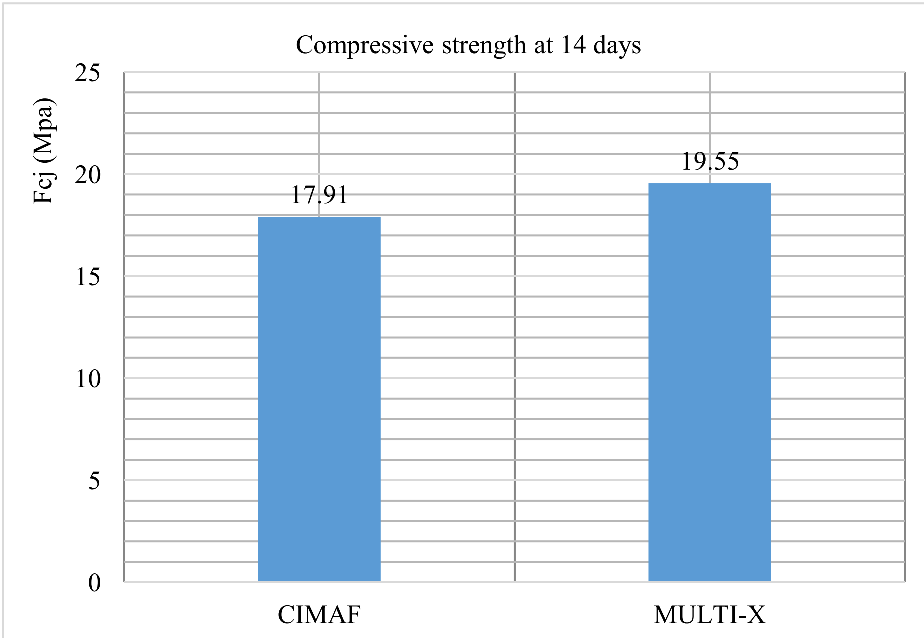


Figure 14 : Compressive Strength at 14 Days

At 14 days, the target compressive strength was not reached for either cement. However, the strength of the Multi-X cement approaches the expected value and remains higher than that of CIMAF, though the difference is less significant than at 3 days.

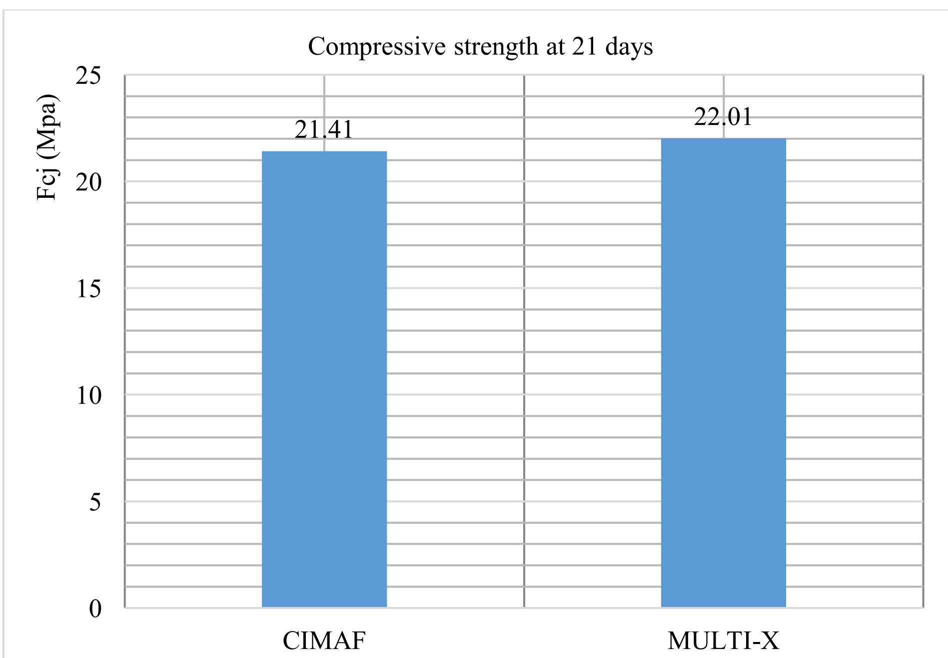


Figure 15 : Compressive Strength at 21 Days

At this stage, the CIMAF cement shows a good increase in strength, yet it remains below the strength of Multi-X cement, which is close to the target compressive value.

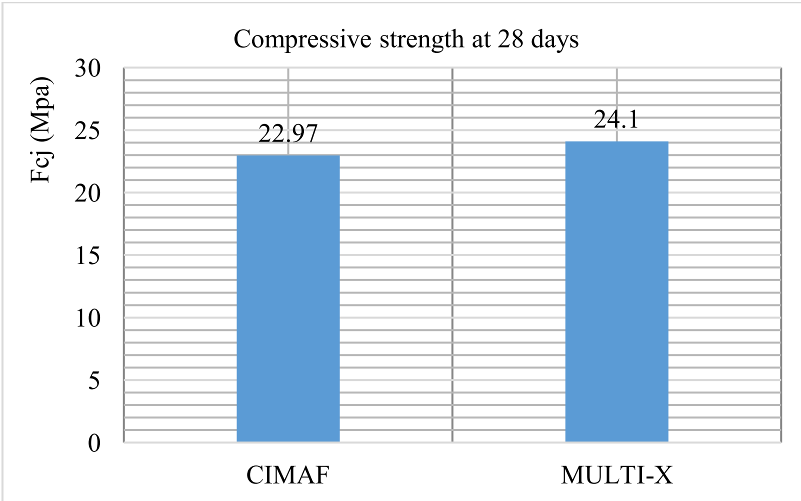


Figure 16 : Compressive Strength at 28 Days

On the 28th day, which marks the end of the strength tests, no major changes were observed. CIMAF CPJ35 still exhibits compressive strength far below the expected results and remains lower than that of Multi-X 32.5R. The three comparative curves below clearly illustrate the evolution of compressive strength for both cements compared to the standard target curve.

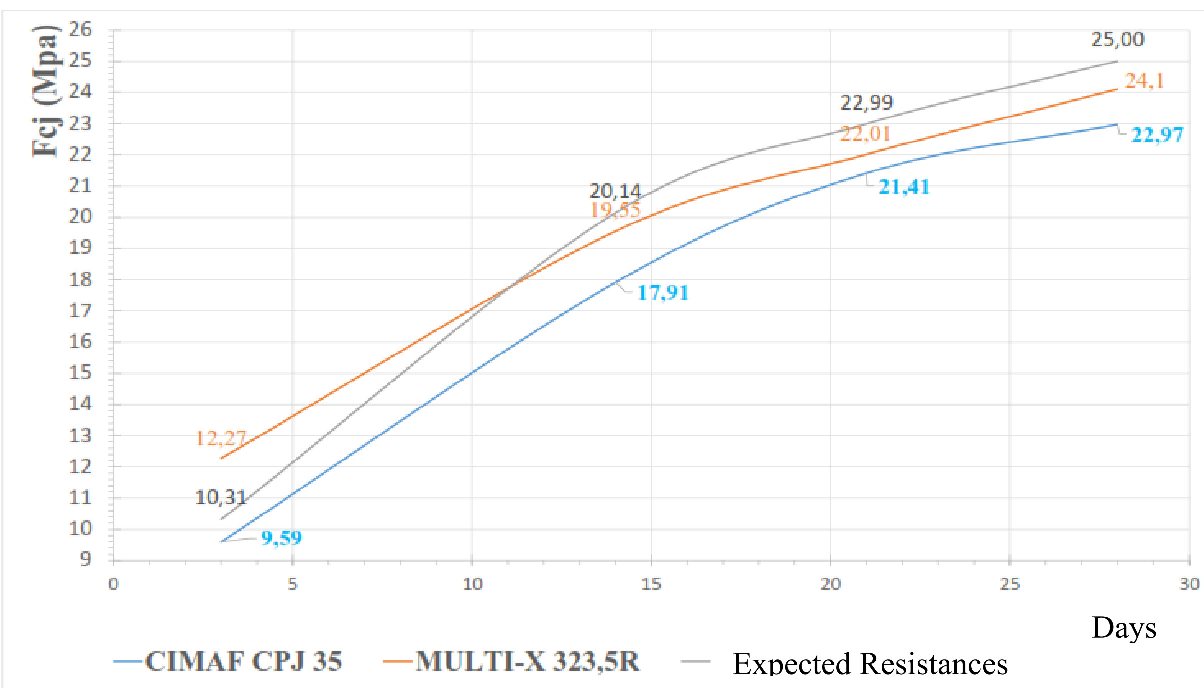


Figure 17 : Comparative Compressive Strength at various ages (3, 14, 21 and 28 days)

Based on these tests, we conclude that concrete made with Multi-X 32.5R cement delivers better compressive strength results than concrete made with CIMAF CPJ35 cement. The Multi-X cement shows very high early-age strength, unlike CIMAF CPJ35, which develops strength more slowly. Even during the maturing period, only the Multi-X cement approaches the expected performance levels.

Conclusion and perspectives

Conclusion

This innovative research addresses the unregulated use of certain hydraulic binders, particularly CPJ35 and CEM II 32.5R cements in concrete, without fully understanding their mechanical specificities. This experimental study on the influence of CIMAF CPJ35 and Multi-X 32.5R cements on the compressive strength of hardened concrete has revealed several critical insights:

- Multi-X 32.5R cement has a rapid setting time, which significantly enhances early-age compressive strength.
- This cement is suitable for structural elements such as slabs, beams, and columns where construction time is limited, as it can withstand loads at early stages.
- Concrete made with Multi-X should be placed immediately after mixing due to its fast setting behavior.

Conversely:

- CIMAF CPJ35 cement has a slower setting rate and demonstrates lower early-age compressive strength.
- It is better suited for Ready-Mix Concrete (RMC), especially for long transport distances.
- CPJ35 is appropriate for low-load applications, unreinforced concrete, and all types of mortar.

From our innovative study, we conclude that among the two cements, only Multi-X 32.5R can reliably provide the desired performance for civil engineering structures. This is not the case with CIMAF CPJ35-based concrete. However, it is important to recall that each cement has its specific advantages, as outlined above.

Given the observed evolution of compressive strength, it would also be valuable to extend this study to include the behavior of these concretes beyond 28 days, even up to several decades.

Perspectives

Despite our findings, several aspects remain to be investigated further. Future research should focus on: Proposing practical design charts (abacuses) based on cement type and required strength or density;

- Conducting mineralogical and chemical studies to understand the internal interactions within these concretes;
- Determining the proportion of each cement component and its influence on concrete behavior from hardening to maturity;
- Identifying chemical admixtures that could enhance the performance of concrete depending on the cement used.

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