INTERNATIONAL JOURNAL OF PROGRESSIVE RESEARCH IN SCIENCE AND ENGINEERING, VOL.4, NO.07, JULY 2023.

Evaluation of Polypropylene Fibers from Shredded Face Masks as Additives in Non-Load Bearing Concrete Hollow Blocks

Jenessa Mae B. David [1], Warren P. De Guzman [1], Gian Russel B. Nunag [1], Alhjey Y. Perez [1], Erica Joy C. Salunga [1], Chestmarc M. Tañamor [1], Ma. Lois G. Dela Cruz [1], Aaron S. Malonzo [1]

[1]College of Engineering and Architecture, Department of Civil Engineering, Don Honorio Ventura State University, Cabambangan, Bacolor, Pampanga, Philippines.

Corresponding Author: jenessamaedavid11@gmail.com

Abstract: - The current study used polypropylene fibers from surgical face masks as additions in non-load-bearing concrete hollow blocks to see if these raw materials affected the mechanical qualities of the standard CHB. However, only the compressive strength test, sieve analysis, and water absorption test were performed in this study other tests were recommended for future researchers who might desire to conduct them. The one conducting the inquiry employed a polypropylene fiber mixture of 0.10%, 0.15%, 0.20%, and 0.25%; this is the same mixture that researchers use in concrete, and it was decided to use it in concrete hollow blocks. As a matter of fact, the ongoing COVID-19 infection has a significant influence not just on the worth of the nation's economy but also on the daily activities of human life, The use of face masks as PPE is one of the prominent and effective PPE measures adopted by several public health and hygiene measures during COVID-19. The compressive strength of concrete hollow blocks containing polypropylene fiber is 31.64% higher than that of traditional CHB, and this sample contains 0.20% (200 grams) polypropylene fibers that were shredded from a surgical face mask.

Key Words: —*Polypropylene Fibers, Non Load Bearing Concrete Hollow Blocks, Covid-19, Surgical face mask.*

I. INTRODUCTION

The ongoing COVID-19 disease has a significant impact on people's health as well as the value of the nation's economy and daily life in general. Utilization of face masks as PPE is one of the notable and effective PPE that numerous public health and hygiene measures have been pursued during COVID-19. Face masks are the main piece of personal protective equipment (PPE) use to control the virus spread, overall number of COVID-19 cases in developed and developing Asia.

Manuscript revised July 17, 2023; accepted July 18, 2023. Date of publication July 19, 2023.

This paper available online at www.ijprse.com

ISSN (Online): 2582-7898; SJIF: 5.59

Country	[a]Population	[a]Total COVID-19 cases	[b]Urban population (%)	Face masks acceptance rate (%)	Number of face mask need of each general population each day	Total daily face mask use (pieces
India	1,381,085,714	1,643,416	35	80	1	381,179,657
Iran	84,077,062	301,530	75	80	1	50,648,022
Pakistan	221,213,683	278,305	35	80	1	61,762,860
Saudi Arabia	34,855,542	274,219	84	80	1	23,367,155
Bangladesh	164,820,045	234,889	75	80	1	99,155,739
Turkey	84,410,984	229,891	39	80	1	26,066,112
Iraq	40,288,721	121,263	96	80	1	30,973,969
Qatar	2,807,805	110,460	60	80	1	1,341,008
Indonesia	273,753,080	106,336	73	80	1	159,214,791
Philippines	109,694,822	89,374	56	80	1	48,967,769

Fig.1. Data's about Covid-19 2020

Additionally, a survey conducted by World Meter COVID 19 Data revealed, at the year of2020, the COVID-19 pandemic database assessed number of masks worn in 49 Asian nations. It was later discovered that the total population for the Asian nations was about 4,612,337,109andconsist of 4,217,589

COVID-19 cases, while the face masks were utilized throughout Asia as a whole is 2,228,170,832. Furthermore, the Philippines attained a total daily face mask use of 48, 967,769(pieces) and a medical waste of 353.03 (tons/day) with the total population and COVID-19 cases of 109,694,822 and 89,374 consecutively.

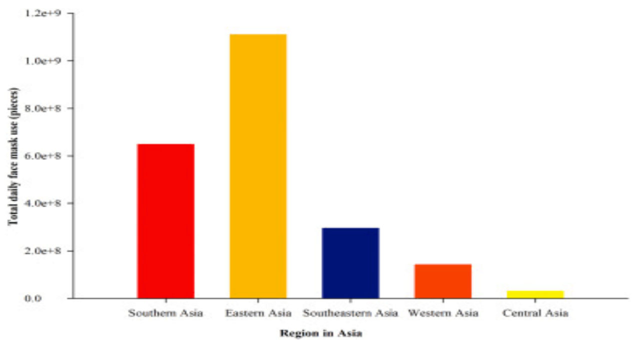

Fig.2. Covid-19 in Asian Nations

Moreover, face mask consists of three layers the center filter layer made of melt-blown polypropylene and an inner and outer layer composed of spun-bound polypropylene. Thus, Facemask wastes are attractive candidates for reuse in cement-based materials

since polypropylene fibers had previously been reported and utilized extensively in the concrete industry due to improvements in some qualities, like shrinkage and strong alkaline resistance, besides the Polypropylene polymerization produces a type of synthetic fiber known as polypropylene fiber (PPF). It provides some benefits, including as low weight, great strength, great toughness, and corrosion resistance. Additionally, the PPF is widely used in the construction, chemical, energy, clothing, and environmental protection, and other industries.

However, CHB has been widely utilized in both developed and developing nations, it today plays a significant part in the modern building sector, particularly because of its capacity to save energy, utilize less materials, have a lower environmental impact, fire-resistant, and require minimal maintenance over its lifetime. It is mainly use for both load-bearing and non-load-bearing walls. Additionally, Load-bearing walls play a crucial role in a building's structure by carrying the weight of the roof and upper floors, transferring it to the foundation. Also, this are essential in areas requiring structural stability, such as exterior walls or spaces housing heavy equipment. On the other hand, non-load-bearing walls do not bear any structural loads and serve as partitions to divide interior spaces, offices, or partitions where the weight-bearing requirements are minimal.

As a matter of fact, the research project focused on facemask waste management and reuse in construction.

The selection of load-bearing or non-load bearing structures depends on considerations such as structural engineering, compliance with building codes, architectural design, and specific project requirements, and in carrying out our research work, non-Load bearing CHB for wall will be utilize in this study.

To sum up, the aim of this research is to contribute to waste management efforts by exploring the potential of reusing used facemasks in the construction industry. By investigating the feasibility of incorporating these materials into construction processes, we can find sustainable solutions for reducing waste generated from disposable facemasks. This research seeks to address both environmental concerns and the resource needs of the construction industry, ultimately aiming to promote a circular economy approach

1.1 Statement of the Problem

The major concern of this study is to strengthen the mechanical properties of concrete hollow blocks using polypropylene fibers that are present in disposable facemask. Concrete hollow blocks provide a number of advantages, including being lightweight, fireproof, soundproof, heat-preserving, impermeable, earthquake-resistant, durable, pollution-free, and energy- and resource-efficient (Cabarle, 2022). Besides of its advantages concrete hollow blocks have also its disadvantages, one of these is that concrete hollow blocks are porous, which means hollow blocks have holes or pores where liquid and air may pass. And one of the reasons why we come up to this study to use the pandemic generated waste which is the face mask and its properties to reduce the porosity in concrete hollow blocks.

In this study we are going to answer the following questions:

- Does the shredded face mask increase the compressive strength of the concrete hollow blocks?
- Which block set up would give a desired maximum compressive strength in terms of percentage added to the mixture?
- What is the optimum shredded face mask is needed in order to increase the strength of Concrete hollow blocks?

1.1.1 General Objectives

The main objective of this study is to assess the Polypropelene Fibers from shredded facemask to improve the mechanical properties of concrete hollow blocks.

1.1.2 Specific Objectives

- To examine which block sample provide the desired maximum compressive strength.
- To identify the effect of surgical masks in the block sample in terms of water absorption percentage.
- The mask proportions in the mixtures were altered, ranging from 0% (control mix) to 0.1%, 0.15%, 0.2%, and 0.25% by volume. Previous study by Al-Hadithi and Hilal (2016), Xu et al. (2020), and Sadiqul Islam and Gupta (2016) informed the selection of these proportions.

1.2 Significance of the Study

The purpose of this study is to improve the performance of concrete hollow blocks by using polypropylene fibers from surgical facemasks. Face masks have been in high demand up until this point because to the COVID-19 situation. The possibility of using this waste face mask as building materials has been considered by the researchers. Based on observation, these worn face masks are found all over our country and it's truly upsetting to see them on the riverside, roads, canals, etc. Polypropylene, a sort of cloth derived from "thermoplastic," is the substance most frequently used to make these masks. They can create flooding because they are difficult to breakdown, just like plastic. The study would also be extremely beneficial for the following:

The Construction Industry. Future studies that investigate these topics will benefit from the analyses provided in this paper, the many advantages of polypropylene fibers and potential raw materials for CHB, which is also beneficial to society.

The Environment. These results will contribute to the ongoing development of fresh concepts for improving our infrastructures while also taking into account the state of our nation, which is presently suffering from the COVID-19 issue that we have been dealing with for more than two years.

By doing this research it will help to avoid the possible harm caused by scattered facemasks because we know that they contain plastic material that takes years to dispose.

1.3 Scope and Limitations

The researchers carefully established limitations and boundaries to ensure the achievement of the study's objectives within the specified time frame, taking into account the challenges posed by the pandemic, government and institution protocols, and travel restrictions. The study was conducted from September 2022 to June 2023, aligning with the academic year 2022-2023.

1.4 Conceptual Framework

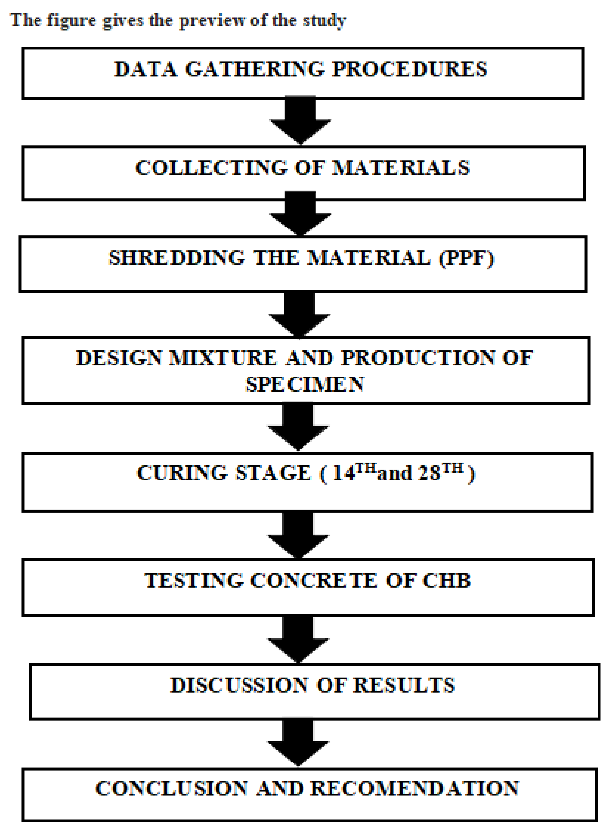

Fig.3. Conceptual Framework

II. Methodology

The study involved experimental research where certain variables were held constant. However, the experimental setup allowed for variation in the proportion of shredded facemasks used in the manufacturing of concrete hollow blocks (CHB). The effectiveness of the additives used in the study was determined by the proportion of materials. The researchers collected data and tested the materials by examining their characteristics in order to achieve a successful outcome.

The gathering of the materials stated within this research took place outside the premises of the university. The surgical masks were collected on the homes and community of the researchers. The sample was shered by the researcher using scissors, and the materials for the mixture were collected in Mexico Pampanga. Each member's home served as the place to clean and dry the facemask. Also, the sand was sieved at the Unified Geotest Laboratory at San Fernando, Pampanga. The concrete mixture and CHB manufacturing preparation took place at San Juan in Mexico, Pampanga. The Compressive Strength and Water Absorption tests were conducted successively at the Department of Public Works and Highways (DPWH) in Sindalan, San Fernando, Pampanga. The manufacturing and curing process of the hollow blocks will be held a Mexico, Pampanga.

2.1 Specification

2.1.1 Disposable Facemask / Surgical Facemask

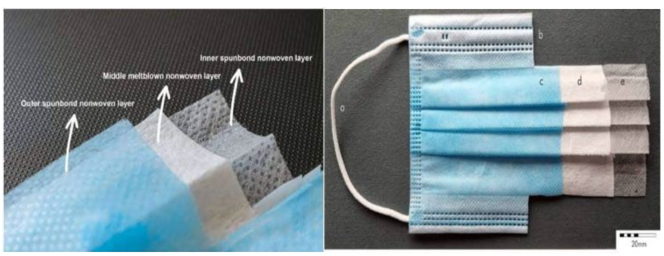

Fig.4. Surgical Facemask

Table.1. Mechanical Properties of Surgical Facemask

MECHANICAL PROPERTIES	SHM	STANDARD
Specific Gravity	0.91	ASTM D792-20 (2020)
Melting Point	160	ASTM D7138-16 (2016)
Water Absorption 24 h (%)	8.9	ASTM D570-98 (2018)
Tensile Strength (MPa)	4.25	ASTM D638-14 (2014)
Tensile Strength at break (MPa)	3.97	ASTM D638-14 (2014)
Elongation at Break (%)	118.9	ASTM D638-14 (2014)

Face Masks feel comfortable and easy to put on and take off, surgical face masks ensure a physical barrier to smoke, droplets, dirt, dust and powder, It can help block pollution so you can breathe easily and safely. Every piece of mask has a polypropylene and there are many types of non-woven polypropylene. The most common are spunbond, meltblown and spunlace materials. And each surgical mask has a length of 6.89 inches, width of 3.72 inches and a weight of 0.5 lb. In this study the facemasks were cut-up into small pieces with a length of 2cm and width of 0.5cm. The mask proportions in the mixtures were altered, ranging from 0% (control mix) to 0.1%, 0.15%, 0.2%, and 0.25% by volume. Previous study by Al-Hadithi and Hilal (2016), Xu et al. (2020), and Sadiqul Islam and Gupta (2016) informed the selection of these proportions.

2.1.2 Cement

For this study the researcher used a Rizal Super Type 1-(Ordinary Portland Cement) is specially formulated and manufactured with natural minerals (Philippine Tuff) to ensure increased strength over time. Portland Cement can also be used to produce stucco per ASTM C-926, and can be used to produce mortar per ASTM C-270. Researcher should follow the proportioning, mixing, and placement procedures as outlined in applicable standards from the ASTM and the American Concrete Institute. The cement was brought by the construction and trading store in Pampanga. Cement has it roles to enhance the workability, compressive strength, drying shrinkage, and durability.

2.1.3 Sand (Fine Aggregates)

Sand fine aggregate used for the study. Fine aggregate it forms the bulk and makes mortar or concrete economical. It provides resistance against shrinking and cracking. It is naturally available.

2.1.4 Water-to-Cement Ratio/ w/c

During building, water is necessary for the preparation of mortar, mixing of cement concrete, and other tasks such as curing. The water ratio for standard CHB production is ranges from 0.50 to 0.55.

2.1.5 Mixture Proportioning

This study objective is to add a raw material in manufacturing the concrete hollow blocks. In line with this, the shredded face masks which consist of polypropylene fibers (PPF) were added in varying percentage of 0%, 0.1%, 0.15%, 0.2%, and 0.25% by volume. The mixture used was 1:6 which means one part of cement and six parts of fine aggregates by volume and a cement to water ratio of 0.50 to 0.55.

Table.2. Design Mix Proportion

MATERIALS	DESIGN PROPORTIONING BY VOLUME (LITER)				
	CONTROL 0%	B1 0.1 %	B2 0.15 %	B3 0.2 %	B4 0.25 %
SAND	6	6	6	6	6
CEMENT	1	1	1	1	1
WATER	0.50	0.50	0.50	0.50	0.50
PPF	0	100 g	150g	200 g	250g

2.2 Data Collection Physical Test (Test for Sieve Analysis Conforming ASTM-C135-05)

- Providing the four different sand samples with the weighted of 500 grams on a weighing scale.
- At the topmost sieve put the 500 grams sand samples and cover with lid. Afterwards, shake the set of sieves from forward to backward motion to clockwise and counter clockwise motion.
- After the 3 to 5 minutes of sieving, the retained sand mass weighted using the weighting scale, then note the cumulative percentage retained on each sieve.
- At last, Fineness Modulus was calculated by the summation of the cumulative percentage retained from the 3/8 (9.5) to the #100 ($150\mu m$) sieves and then dividing it by 100. The calculation was written as follows:

$$FM = \frac{\sum(Cumulative\ \%\ RetainedonStandardSieves)}{100}$$

Mechanical Test

Weighted Test conforming to DPWH Standard Specification Item 1046- Masonry works

The purpose of this test is to see how the Shredded facemask affect the Concrete hollow blocks.

- Four concrete hollow blocks samples were used as a sample.
- Determine the weight of the hollow blocks, after that, measure the height, length, and dimension of the holes of the concrete.
- The Density of CHB will be calculated by dividing the weight of the block unit by the dimensional volume. the calculation was written as follows.

$$Density = \frac{MassofCHB\ (kg)}{VolumeofCHB\ (m3)}$$

Water Absorption Test

Water absorption test conforming to DPWH Standard Specification 1046.4- Strength Requirements, (ASTM C140) Standard for testing Concrete Masonry Units.

- Determine the mass of each CHB sample and record it as "The Mass sample (1),"
- Dry the CHB in a ventilated oven at 110 to 115 degrees. to a constant weight for at least 24 hours and obtain the dry weight. Calculate the mass of each sample at the same time and record it as the " Dry Mass (2)
- Soak the test specimen entirely in a container of water for 24 hours. Also, record the weight of the specimen while suspended by wire and entirely submerged in water as " Immersed Mass (4)"
- Remove the sample from the container and wipe visible surface water with a dump cloth before weighing. Take note of "Wet Mass (3)."

$$Moisture\ Content,\ \% = \frac{(1) - (2)}{(3) - (4)} X\ 100$$

$$Water\ Absorption,\ kg/m3\ \% = \frac{(3) - (2)}{(3) - (4)} X\ 100$$

$$Water\ Absorption,\ \% = \frac{(3) - (2)}{(3)} X\ 100$$

Compressive Strength Test

Compressive Strength Test Conforming to Department of Works and Highways (DPWH) Standard Specification 1046.4 - Strength Requirements and American Society and Testing Materials (ASTM C90-90).

The compressive test is one of the instruments that was used to determine the compressive strength of concrete.

- 16 specimen hollow blocks will be going to present to test the compressive strength while 3 phases will be conduct.
- Specimens must calculate the net area by checking every block but the area of the holes are not included. Also, Steel scales can be used for appropriate measurement.
- The specimen is loaded onto the compressive test machine, the machine is operational, and has a movable crosshead to compress the concrete specimen until it fails. At the point of failure, the value from the gauge is recorded and the maximum compressive strength of concrete will calculate by the given formula below.

$$\text{Compressive Strength} = \frac{Maximumloadatfailure}{NetArea}$$

III. Results And Discussion

In this chapter, the findings of a series of tests are presented and examined in tables and figures. Details are also provided for each sort of test result. It demonstrates significant data that is employed in the analysis and interpretation of the study. The information in the tables and charts was carefully gathered through a series of experiments.

3.1 Physical Test Results

Table.3. Fineness Modulus of Sand

$$FM = \frac{\mathbf{291}}{\mathbf{100}} = \mathbf{2.91}$$

A test of sieve analysis was conducted by the researchers using a sample of 500 g of sand. It was determined using the tabular data that the resulting fineness modulus of sand of 2.91, and is within the range of the fine aggregate's specification set which indicates that the average fine aggregate value falls between the second and third sieves. Typically, the range of the average fine aggregate diameter size is 0.30mm to 0.60mm.

3.2 Compressive Strength Test Result

Compressive Strength Test Conforming to Department of Works and Highways (DPWH) Standard Specification 1046.4 - Strength Requirements and American Society and Testing Materials (ASTM C90-90).

Table.4. Compressive Strength Test Result Of 14 Day Cured Original Mix CHB

Sieve Size	Weight Retained (grams)	Cumulative		
		Weight Passing (grams)	Percent Retained	Percent Passing
3/8" (9.5 mm)	0	485	0.00	100
#4 (4.75mm)	6	479	1.24	98.76
#8 (2.36mm)	36	443	8.66	91.34
#16 (1.18mm)	90	353	27.22	72.78
#30 (0.59mm)	50	303	37.53	62.47
#50 (0.295mm)	92	211	56.49	43.51
#100 (0.15mm)	106	105	78.35	21.65
#200 (0.075mm)	18	87	82.06	17.94
TOTAL:			= 291	

CONCRETE HOLLOW BLOCKS ORIGINAL MIX										
I.D.	DESCRIPTION	DATE SAMPLED	DATE TESTED	AGE IN DAYS	DIMENSION L	DIMENSION W	AREA,SQ. MM.	MACHINE READING (KN)	COMPRESSIVE STRENGTH MPA	COMPRESSIVE STRENGTH PSI
A	CONCRETE HOLLOW BLOCK	03/28/2023	04/11/2023	14	399	95	37905	32.71	0.86	125
B					402	96	38592	47	1.22	177
C					404	97	39188	13.97	0.36	52
AVERAGE:									0.813	118

The results in this table are the test executed in the fourteen days of curing in original mix of face masks. In computing the individual strength of each sample, just divide the machine reading in the area of the CHB and then convert MPa to Psi. In this table the individual strength of samples A, B, and C are 125, 177 and 52 PSI respectively. And in computing the average, just add the results of the three samples and then divide it to the number of samples. In this case the average of the three samples is 118 PSI.

Table.5. Compressive Strength Test Result Of 14 Day Cured with 0.10% x CHB

CONCRETE HOLLOW BLOCKS 0.10% MIX										
I.D.	DESCRIPTION	DATE SAMPLED	DATE TESTED	AGE IN DAYS	DIMENSION L	DIMENSION W	AREA,SQ. MM.	MACHINE READING (KN)	COMPRESSIVE STRENGTH MPA	COMPRESSIVE STRENGTH PSI
A	CONCRETE HOLLOW BLOCK	03/28/2023	04/11/2023	14	398	96	38208	32.71	0.84	122
B					399	96	38304	23.03	0.60	87
C					399	96	38304	30.24	0.79	114
AVERAGE:									0.743	107.667

0.10% Mix

The results in this table are the test executed in the fourteen days of curing with the 0.10% additive of face masks. The results for samples A, B, and C are 122, 87 and 114 PSI respectively. The average of the three is 107.667 PSI.

Table.6. Compressive Strength Test Result Of 14 Day Cured with 0.15% Mix CHB

CONCRETE HOLLOW BLOCKS 0.15%MIX										
I. D.	DESCRIPTION	DATE SAMPLED	DATE TESTED	AGE IN DAYS	DIMENSION		AREA,SQ. MM.	MACHINE READING (KN)	COMPRESSIVE STRENGTH	
					L	W			MPA	PSI
A	CONCRETE HOLLOW BLOCK	03/28/2023	04/11/2023	14	400	96	38400	31.89	0.83	120
B					399	98	39102	32.51	0.83	121
C					404	97	39188	21.11	0.54	78
AVERAGE :									0.733	106.333

0.15% Mix

The result in this table is the compressive strength test executed in the fourteen days of curing with 0.15% of face masks. The results for sample A, B, and C are 120, 121, 78 PSI respectively. While the average of the three is 106.333PSI.

Table.7. Compressive Strength Test Result Of 14 Day Cured with 0.20% Mix CHB

CONCRETE HOLLOW BLOCKS 0.20%MIX										
I. D.	DESCRIPTION	DATE SAMPLED	DATE TESTED	AGE IN DAYS	DIMENSION		AREA,SQ. MM.	MACHINE READING (KN)	COMPRESSIVE STRENGTH	
					L	W			MPA	PSI
A	CONCRETE HOLLOW BLOCK	03/28/2023	04/11/2023	14	399	97	38703	40.95	1.06	153
B					402	96	38592	42.87	1.11	161
C					400	95	38000	39.80	1.05	152
AVERAGE :									1.073	155.333

0.20% Mix

In this table the results are the compressive strength test executed for the fourteen days curing with 0.20% of face masks. The results for the sample A, B, and C are 153, 161, 152 PSI respectively and the average of the three sample is 155. 333 PSI.

Table.8. Compressive Strength Test Result Of 14 Day Cured with 0.25% Mix CHB

CONCRETE HOLLOW BLOCKS 0.25%MIX										
I. D.	DESCRIPTION	DATE SAMPLED	DATE TESTED	AGE IN DAYS	DIMENSION		AREA,SQ. MM.	MACHINE READING (KN)	COMPRESSIVE STRENGTH	
					L	W			MPA	PSI
A	CONCRETE HOLLOW BLOCK	03/28/2023	04/11/2023	14	399	95	37905	32.71	0.86	125
B					402	96	38592	47	1.22	177
C					404	97	39188	13.97	0.36	52
AVERAGE :									0.813	118

0.25% Mix

In this table the given results are the compressive strength test executed for fourteen days of cuing with 0.25% of the additive. The results for the sample A, B, and C are 125, 177 and 52 PSI. The average of the three sample is 118PSI.

Fig.5. Graphical Presentation of The Averages Per Specimen

The results shown in the table were the tests executed in the fourteen-day curing of the Concrete Hollow Blocks sample. According to the table, the two samples containing 0.10% and 0.15% of PPF failed to exceed the compressive strength of the control sample; however, the sample containing 0.20% exceeded the compressive strength of the control sample, while 0.25% produced an exact value similar to the control sample.

The fourteen-day curing time resulted in a compressive strength of 118 for the control sample, which is the original CHB mix. However, the sample mixture containing 0.20% PPF outperformed the control sample by 31.64% more powerful than the original mix. There are two other combinations that did not outperform the control sample: 0.10% and 0.15%. By calculating the difference in power, the two blends are less powerful than the original by 8.76% and 9.89%, respectively.

Finally, the 0.25% yielded the same result as the control sample.

The findings of the fourteen-day curing of Concrete Hollow Blocks samples were calculated and clearly depicted in the chart. We can see from the statistics and figures above that the B-3 or 0.20% mixture is more potent than the control sample, even if the minimum strength requirements are no longer met. When compared to no mixing, the effect of adding PPFs is very substantial.

3.3 Compressive Strength Test Results for a 28-day-cured Concrete Hollow Blocks

Table.9. Compressive Strength Test Result Of 28 Day Cured Original Mix CHB

CONCRETE HOLLOW BLOCKS ORIGINAL MIX										
I.D.	DESCRIPTION	DATE SAMPLED	DATE TESTED	AGE IN DAYS	DIMENSION		AREA,SQ. MM.	MACHINE READING (KN)	COMPRESSIVE STRENGTH	
					L	W			MPA	PSI
A	CONCRETE HOLLOW BLOCK	03/27/2023	04/24/2023	28	403	97	39091	24.05	0.62	89
B					400	96	38400	25.22	0.66	95
C					398	98	39004	38.04	0.98	141
AVERAGE :									0.753	108.333

The table shown are the test results executed for the twenty-eight days of curing of the original mix of CHB. The results for sample A, B, and C are 89, 95 and 141PSI respectively and the average of the three is 108.333 PSI.

Table.10. Compressive Strength Test Result Of 28 Day Curing with 0.10% mix of CHB

CONCRETE HOLLOW BLOCKS 0.10% MIX										
I.D.	DESCRIPTION	DATE SAMPLED	DATE TESTED	AGE IN DAYS	DIMENSION		AREA,SQ. MM.	MACHINE READING (KN)	COMPRESSIVE STRENGTH	
					L	W			MPA	PSI
A	CONCRETE HOLLOW BLOCK	03/27/2023	04/24/2023	28	401	98	39298	32.98	0.84	122
B					402	97	38994	30.75	0.79	114
C					403	97	39091	32.50	0.83	121
AVERAGE :									0.82	119

0.10 Mix

The result in this table is the compressive strength test executed in the twenty-eight days of curing with 0.10% of additives. The results for compress A, B, and C are 122, 114, and121 PSI. While the average of the three is 119 PSI.

Table.11. Compressive Strength Test Result Of 28 Day Curing with 0.15% mix of CHB

CONCRETE HOLLOW BLOCKS 0.15% MIX										
I.D.	DESCRIPTION	DATE SAMPLED	DATE TESTED	AGE IN DAYS	DIMENSION		AREA,SQ. MM.	MACHINE READING (KN)	COMPRESSIVE STRENGTH	
					L	W			MPA	PSI
A	CONCRETE HOLLOW BLOCK	03/27/2023	04/24/2023	28	404	97	39188	31.98	0.82	118
B					402	97	38994	37.25	0.96	139
C					400	97	38800	32.75	0.84	122
AVERAGE :									0.873	126.333

0.15% Mix

The result in this table is the compressive strength test executed in the twenty-eight days of curing with 0.15% of additives. The results for sample A, B, and C are 118, 139, and122PSI respectively, while the average of the three is 126.333 PSI.

Table.12. Compressive Strength Test Result Of 28 Day Curing with 0.20% mix of CHB

CONCRETE HOLLOW BLOCKS 0.20% MIX										
I.D.	DESCRIPTION	DATE SAMPLED	DATE TESTED	AGE IN DAYS	DIMENSION		AREA,SQ. MM.	MACHINE READING (KN)	COMPRESSIVE STRENGTH	
					L	W			MPA	PSI
A	CONCRETE HOLLOW BLOCK	03/27/2023	04/24/2023	28	402	97	38994	33.84	0.87	126
B					402	97	38994	30.59	0.78	114
C					403	97	39091	26.80	0.69	99
AVERAGE :									0.78	113

0.20% Mix

The results in this table are the compressive strength test executed for the twenty-eight days of curing containing 0.20% of additives. The results for the sample A, B, and C are 126, 114, 99 PSI while the average of the three is 113 PSI.

Table.13. Compressive Strength Test Result Of 28 Day Curing with 0.25% mix of CHB

CONCRETE HOLLOW BLOCKS 0.25% MIX										
I.D.	DESCRIPTION	DATE SAMPLED	DATE TESTED	AGE IN DAYS	DIMENSION		AREA,SQ. MM.	MACHINE READING (KN)	COMPRESSIVE STRENGTH	
					L	W			MPA	PSI
A	CONCRETE HOLLOW BLOCK	03/27/2023	04/24/2023	28	399	96	38304	23.52	0.61	89
B					404	97	39188	26.68	0.68	99
C					400	96	38400	26.13	0.68	99
AVERAGE :									0.657	95.666

0.25% Mix

In this table the given results are the compressive strength test executed for twenty-eight days of cuing containing 0.25% of the additives. The results for the sample A, B, and C are 89, 99 and 99 respectively. While the average of the three is 95.666PSI.

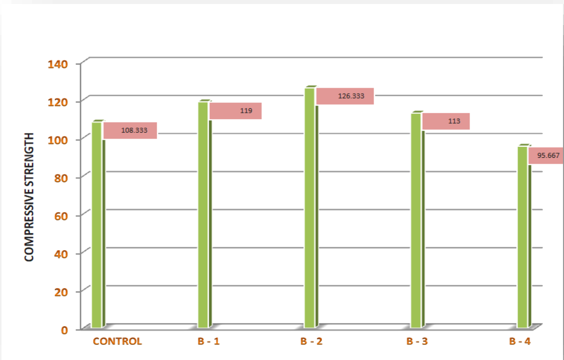

Fig.6. *Graphical Presentation of The Averages Per Specimen*

The table shows that 0.10%, 0.15% SD, and 0.20% outperformed the compressive strength of the control sample, with 0.20% consistently surpassing the original mix. However, 0.25%, which had the same value as the control sample after 14 days of curing, did not exceed the value after 28 days and had the lowest amount of strength among them.

The data obtained during the CHB curing period of 28 days are tallied and displayed above. It was revealed that the compression test result after 28 days curing is superior to the 14-day curing. We can see from the data in the table that the three sample combinations outperformed our control sample. The combinations in question are 0.10%, 0.15%, and 0.20%. Even if only one exceeded the 14-day curing period, it had the greatest value of all those who exceeded the control sample.

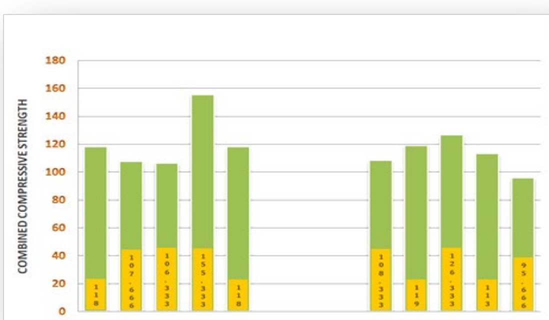

Fig.7. *Graphical Presentation of The Averages Per Specimen of 14 and 28 curing*

Although it did not reach the minimal strength standards, we can observe that combining PPF and CHB has a significant effect on compressive strength. However, one mixture in 28-day curing failed to outperform the control sample, and that is the 0.25%.

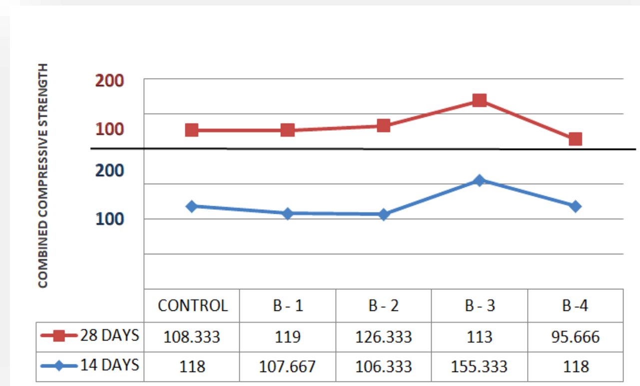

Fig.8. *Line Graph Presentation of The Averages Per Specimen of 14 and 28 curing*

When all of the information compiled was added together, it turned out that 0.20% is the most potent strength among all of the tests. Data show that it stays dominant on all types of days, with the highest compressive strength of 155.33 after 14 curing days. It has the potential to surpass the original blend in compressive strength by over 31%.

3.4 Classification of Concrete Hollow Blocks by Weight Density

The density of a concrete hollow block can be used to determine its weight classification. The researchers tabulated the resulting values of 14 and 28 days of curing from the control sample to the various mixes mentioned above.

Table.14. Results Of Density Test Of CHB

DENSITY OF HOLLOW BLOCKS RESULTS					
Sample Identification	Average Mass (kg)		Volume	DENSITY (kg/m³)	
	14 DAYS	28 DAYS	(m3)	14 DAYS	28 DAYS
CONTROL 0%	6.99	6.94	0.00727	961.49	954.61
B -1 0.10%	6.82	6.99	0.00727	938.10	961.49
B -2 0.15%	6.91	6.77	0.00727	950.48	931.22
B -3 0.20%	7.06	6.97	0.00727	971.11	958.73
B – 4 0.25%	6.99	6.71	0.00727	961.49	922.97

If we look closely, we can see that the results of the 14-day curing of CHB are less than 1680 kg/m3, implying that it is only confined as lightweight masonry blocks. These have a total average of just 956.534 kg/m3, with B-3 having the highest value with a difference of only 1.01% from the control sample, and B-1 having the lowest value with a difference of 2.43%.

However, the total average for 28-day CHB curing is lower than that of 14-day curing, which is 945.804 kg/m3. B-2 obtained the lowest density; it was lower by 3.31% compared to the control sample, whereas B-1 obtained the largest quantity, which had a lower value in 14-day curing but currently has the highest value.

3.5 Water Absorption test

Table.15. Results of Water Absorption Test for CHB

PERCENTAGE WATER ABSORPTION RESULTS										
Sample Identification	14 DAYS				28 DAYS				WaterAbsorption%	
	M_1	M_2	M_3	M_4	M_1	M_2	M_3	M_4	14 DAYS	28 DAYS
CONTROL 0%	6.99	8.03	3.22	6.87	6.94	8.00	3.16	6.79	16.89	17.82
B-1 0.10%	6.82	7.89	3.11	6.82	6.99	8.03	3.19	6.78	15.69	18.44
B-2 0.15%	6.91	7.96	3.09	6.68	6.77	7.80	12.15	6.56	19.16	18.90
B-3 0.20%	7.06	8.09	3.24	6.86	6.97	8.06	3.23	6.83	17.93	18.01
B – 4 0.25%	6.99	8.03	3.23	6.53	6.71	7.81	2.87	6.57	22.97	18.87

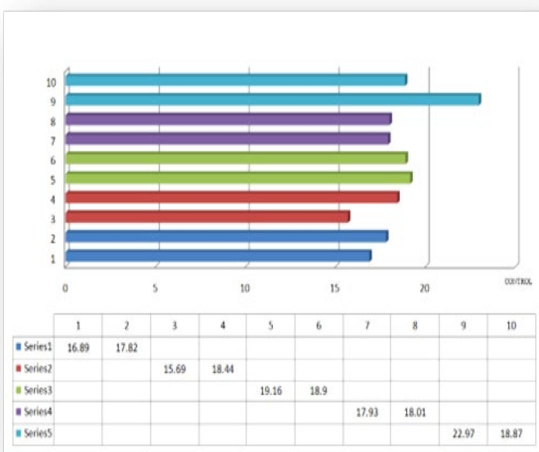

Fig.9. Graphical Presentation of the Results for Water Absorption Test

IV. CONCLUSION

4.1 Summary

This section presents a condensed overview of the study's findings, in accordance with its objectives. The summary is based on the results gathered through testing, along with the critical aspects that led to the conclusion.

- The study utilized a sample sand with a fineness modulus of 2.09 and an average diameter size for fine aggregates ranging from 0.59 to 0.295, according to the findings. Moreover, these values were found to be within the range specified by ASTM for fine aggregates, which typically falls between 2.3 and 3.1.
- The average compressive strength of concrete hollow blocks after 14 days of curing and with 20% SF (B-3) was found to be 155.333 PSI, while the average compressive strength after 28 days of curing and with 0.15% SF was found to be 126.333 PSI.
- After a 14-day curing period, the compressive strength test was conducted, and the B-3 setup exhibited the highest average value of 155.333 PSI, which was 23.04% higher than the control sample.
- During the curing days, B-4 was recorded to have the lowest density value of 922.97 kg/m3 or 4.01% lower than the control sample, indicating that it met the standard requirement for lightweight concrete hollow blocks with a density of less than 1680 kg/m3.
- During the water absorption tests, it was found that B-4 had a higher absorption rate of 36.23% compared to the control sample, indicating that B-4 absorbed more water. The control sample, on the other hand, had the lowest water content value among the block samples tested, as evidenced by the 14- and 28-day tests.
- Surgical Shredded facemask can be used as additives in to formulation of concrete hollow blocks where it's proven the that the sample blocks have much higher compressive strength than the control sample.

4.2 Conclusions

- The researchers obtained the following results from their study on the use of shredded facemasks as additives in concrete hollow blocks.
- The findings of the research demonstrate that the addition of SF to the CHB formulation can result in improvements in both the compressive strength and

density of the blocks. However, the use of SF to the CHB may also lead to an increase in the percentage of water content in the chb.

4.3 Recommendations

This study was conducted to assess the effectiveness of incorporating shredded facemasks as additives in concrete hollow blocks. Through this research, the researchers have identified areas where improvements can still be made to derive a better alternative to the disposal of medical waste, such as surgical facemasks. The study's outcomes have instilled confidence in using this raw material in construction procedures. The findings suggest that further research on using surgical shredded facemasks as additives in concrete hollow blocks could be considered for future development. Recommendations for expanding the research include drawing from previous readings not covered in this study, implementing additional measures and analyzing outcomes.

- To further investigate the potential of incorporating surgical shredded facemasks into concrete hollow blocks, additional testing and analysis, such as drop tests, workability tests, and other feasible assessments, could be conducted.
- To expand the knowledge on the use of shredded facemasks as an additive in construction, future studies could investigate its efficacy in different aspects of construction, such as concrete plaster. Additionally, identifying the most suitable cement-based material for this application can be explored to improve the potential of this approach in the construction industry.
- Investigating and assessing the properties of a different design mixture type and class ratio for concrete hollow blocks using the same replacement intervals, in order to fulfill the minimum strength requirements of DPWH 1046.4.
- Perform and examine the 7th curing stage.
- Further investigate the mechanical properties of concrete hollow blocks and Face masks through the following test Modulus of Elasticity, Tensile strength and Elongation.
- Test and analyze the Drop Test such as Vertical and Horizontal drop test, Chisel Test and Texture Test, under the Physical Test.

REFERENCES

[1]. Marta Castellote*, Eva Jiménez-Relinque , María Grande, Francisco J. Rubiano and Ángel Castillo (2022) “Face Mask Wastes as Cementitious Materials: A Possible Solution to a Big Concern” Institute of Construction Science Eduardo Torroja (IETcc-CSIC), 28050 Madrid, Spain.

[2]. Parija, Mishra,and Leung (2021) "Preliminary Results Of Concrete with Shredded Disposable Face Masks" Department of Civil and Environment as lEngineering, Hongkong University of Science and Technology (HKUST).

[3]. Mohammad Saberian, Jie Li,∗ Shannon Kilmartin-Lynch, and Mahdi Boroujeni”Repurposing of COVID-19 single-use face masks for pavements base/subbase” National Library of Medicine, National Canter for Biotechnology Information. (2021).

[4]. Md. Hasibul Hasan Rahat (July, 2022) “A Process for Utilizing Disposable Face Masks in Hot Mix Asphalt (HMA) Pavement Construction” Martin, Tony.; Selly, Dominic (2002), 'Visual Basic.NET At Work: Building 10 Enterprise Projects', New York John Wiley & Sons, Inc.

[5]. Dr. Jayeshkumar Pitroda, Krunalkumar A. Bhut, Hardik A. Bhimani, Sagar N. Chhayani, Uday R. Bhatu, Nirav D. Chauhan “A Critical Review on Non-Load Bearing Wall Based on Different Materials” International Journal of Constructive Research in Civil Engineering (IJCRCE),2016.

[6]. Shannon Kilmartin-Lynch, Mohammad Saberian, Jie Li,∗ Rajeev Roychand, and Guomin Zhang (2021) “Preliminary evaluation of the feasibility of using polypropylene fibres from COVID-19 single-use face masks to improve the mechanical properties of concrete.”Das, Souripriya; Chong, Eugene Inseok; Eadon, George; Srinivasan, Jagannathan (2004), 'Supporting Ontology-based Semantic Matching in RDBMS'. Paper presented at Very Large DataBase conference, Oracle Corporation.