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Mathematical Models Evaluation for High Rise Structure thru Reconditioned Substances Strong suit parameters

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Abstract

This article aims to present a new and simple mathematical model that can determine the optimal position of truss reinforcement systems in high-rise buildings. Displacements caused by lateral loads have the least stress and deformation in the elements and construction. From the beginning of its construction to the present, concrete has played a considerable role in architecture. The mechanical properties of concrete, such as compressive strength, elastic modulus, and different tensile strength (flexural strength, inherent tensile strength, and tensile strength per unit), are essential aspects when calculating and determining the size of concrete structures. Compressive strength and tensile strength are important parameters to measure the quality of concrete structures. The design criteria of concrete structures depend on the compressive strength of concrete in most cases. It is not designed for direct loading. Tensile strength should be considered because it has a significant effect on stress cracking. In addition, the tensile strength of concrete needs to be determined.

1. Introduction

The topic discussed here is the mathematical model of concrete performance after adding rubber and glass slag. Please pay special attention to the mathematical expression of these models, which makes them very versatile and suitable for describing the performance of concrete with different physical properties [(D. Li)]. Natural. However, there are two other reasons for this emphasis. First, as pointed out by A. Einstein, mathematics enjoys high respect in all other sciences because its laws are concrete and indisputable. Mathematics has achieved and maintained this unique status because its results are based on several (more or less self-evident) axioms derived from error-free reasoning (Mohammed and Adamu) . For this reason, the strict mathematical representation of natural sciences is very desirable and should be tried whenever possible. In addition, mathematics is often used to communicate between scientists and engineers in different fields (Shoaei and Parham). Therefore, when a specific scientific field is presented in a strictly mathematical form, its usability will increase significantly. It is hoped that the mathematical description of the specific model generated here will bring much-needed clarity to the field and make it attractive to more interested researchers (Patel et al.) . An engineer wrote this monograph for engineers. For this reason, mathematics here is mainly used as a tool for clarity. When mathematically testing a model based on accurate data, we often need to verify whether the data matches the equation. If the relationship is linear, that is, it has the form y = mx + c. It is easier to see if the data is straight and determine the slope m and the point of intersection (Safarizki) . However, if the relationship is not linear, it is not easy. One of the methods used is to convert a nonlinear equation into a linear equation by changing variables. Therefore, if we have a relationship similar to y = ax2 + b, we can draw y according to x2 to obtain a line graph with a gradient of a and an intersection point b instead of drawing a y versus x to obtain a nonlinear graph. When we have a relationship of the form y = a / x, we can draw a graph of the relationship between a and 1 / x to obtain a line graph with a gradient. The development of the strength of concrete is affected by many factors, such as cement composition and fineness, water-to-cement ratio, aggregate, age, and temperature of curing (Tang, Cheng, and Tsai) . Unfortunately, no such formula (mathematical model) could reproduce the effects of all these factors adequately quantitatively, primarily due to a high number of variables.

2. Waste Rubber:

It has been recognized that the production of hard trash and the related disposal difficulty in the present era are significant issues that significantly impact the environment and human life. The hazardous and non-biodegradable trash generated in enormous quantities brings a considerable danger to our environment (Chandrappa and Biligiri) .

In the modern era, India contributes around 6-7% of the waste tire generation worldwide. The production of trash rubber tires in India increases by 12% per year in the tyre manufacturers.

FIGURE 1. Waste Tyres and Glass dumped in the open area.

Crumb Rubber (CR) scrap is a substance obtained by shredding the tires into uniform small granulates (Pacheco-Torres et al.) . The properties of CR depend upon the source of scrap tires, which are usually: car tires and truck tires. In this paper, treated and non-treated CR was used at 0%, 4%, 4.5%, 5%, and 5.5% by the weight of Fine Aggregates to enhance the properties of concrete (Chen, L. Li, and Xiong Agnihotri) . As a result, metric tons of glass were recycled worldwide, representing 21% of the total glass production in that year. Container glass (i.e., beer and soft drink bottles; wine and liquor bottles; and bottles and jars for food, cosmetics, and other products) accounted for the highest recycling rate among glass materials, with around 32% of waste recycled. This statistic still shows today that the amount of glass waste available is significant, and its disposal as a landfill generates high environmental and financial costs.

Bisht, Kunal, and P.V. Ramana (Bisht and Ramana Ramana and Agnihotri) also observed that the workability of concrete made using waste glass as the acceptable aggregate replacement was increased with a replacement level up to 40%. After that, a reduction in a slump was observed. Thus, an increase in workability may be due to the non-water absorbent nature of waste glass compared to natural sand (Surendranath, Ramana, et al. Meena Surendranath and Ramana) . However, a decrease in a slump may be due to the loss of adequate water from specimens through rapid transportation caused by more voids produced by equivalent waste glass components instead of natural sand being heavier than the latter.

Gehlot, Tarun, et al. (2020) (Gehlot) various concluding remarks of this research study are below. With the accumulation of 15% & 20% of Ground Granulated blast furnace slag as a partial cement substitute for M30 grade of concrete, there is an enlargement in compression strength of concrete compared to solitary when no substitution had been made.

L. Dvorkin et al. (2012) (Dvorkin et al.) While using waste glass as an acceptable aggregate replacement, 28 d strength is marginally increased up to 20% replacement level. A marginal decrease in strength is observed at 30 to 40% replacement level of waste glass with fine aggregate. Therefore, waste glass can effectively be used as an acceptable aggregate replacement. The optimum replacement level of waste glass as fine aggregate is 10%.

Komolafe, O. O., et al. (O Komolafe et al.) The compressive strength of crumb rubber concrete with 5% replacement is 38.66 N/mm2; it is higher than the strength of standard concrete (36.73N/mm2) on the 28th day. The compressive strength of crumb rubber concrete with 10% replacement gives adequate strength of 33.47 N/mm^2.

3. Problem Statement

In building structures, concrete is standard using material and concrete made up of different constituents. With the variation of these constituents, the mechanical properties vary drastically; these properties are measured with the help of performing the last number of laboratory tests. If we want to perform all tests and know all properties, it takes approximately 3-4 months. Which are considerable time and present world of modernization we cannot wait such a long time only to know the property of concrete and also, we cannot compromise with the quality.

There are fantastic mathematical tools that can help us to resolve the problem. So, with the help of different mathematical equations, we can predict the properties of concrete. For this, we have to collect data a single time, and after forming equations, we can find the properties of concrete by varying different constituents.

The problem is divided into two parts:

- When fine aggregate is replaced by crumbled rubber.
- When fine aggregate is replaced by waste glass.

4. Methodology

The process of creating a mathematical model is called mathematical modelling. For this reason, in mathematical modelling, a problem is extracted from the real world and written as an equivalent mathematical problem. Then solve the math problem and explain the solution based on the actual problem. Then one will see how effective the solution is in the context of the actual problem. Therefore, the stages of mathematical modelling are formulation, solution, Interpretation, and verification. The formula includes the following three steps: Formulate the problem Determine the relevant factors Mathematical description Step 2: Find the solution: The mathematical formula does not provide a solution. One may need to solve the mathematical equivalent of this problem. Knowledge of mathematics is beneficial here. Step 3: Explain the solution: The mathematical solution is one or more values of the variables in the model. We need to go back to a real-life problem and see what these values mean in the problem. Step 4: Verify the solution: As we saw in A2.3, we need to check whether the solution is in line with the actual situation after finding the solution. The model is ok. If the mathematical solution is inappropriate, we will return to the formulation step and improve our model. This stage of the process is the critical difference between solving language problems and mathematical modelling. This is one of the most critical steps. There are no textual problems in modelling. Of course, we may not need to check our answers in some real-life because the problem is simple; one can get the right solution right away, just like the first model we considered. The sequence of steps in process of a mathematical model is shown in Figure 2. below. A dashed arrow indicates the transition from the verification phase to the compilation phase. This is because you may not have to repeat this step.

5. Classification of Materials

Raw ingredients used for this work and their descriptions are shown below section.

1. Cement: (PPC)conforming to IS 1489 (2015)
2. Fine Aggregate: Zone II as per IS 383 (2016) and the substitution of fine aggregates by WG was made in proportions of 0% (WG0), 18% (WG18), 19% (WG19), 20% (WG20), 21% (WG21), 22% (WG22), 23% (WG23) and 24% (WG24) to prove the exact optimum substitution level.
3. Coarse Aggregate: the size of 10 mm and 20 mm was used per IS 383 (2016).
4. Crumb Rubber: Crushed crumb rubber (CR) of size 0.600 mm
5. Waste-Glass: The crushed form of WG was passed through 600 microns and retained on a 150-micron sieve.
6. Super-Plasticize: Modified polycarboxylic ether-based superplasticizer was procured from BASF.

6. Experimental Results and Discussion

6.1. Compressive Strength

Figure 1. shows the waste tyre and glass dumped in open area. It depicts the specimens' compression effects at 28 and 90 days for all varying rubber and glass contents mixes. The incorporation of rubber and glass into concrete has enhanced its compres-

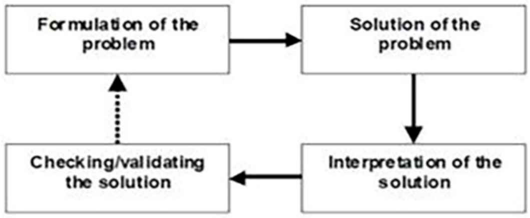

FIGURE 2. **A Process of a Mathematical Model**

sive ability. The concrete has control mix and rubber content varying from 4% to 5.5% with increasing 0.5% and similarly waste glass variation from 18% to 24% by increasing 1% gradually. There was a significant decrease in the compressive force for rubber and an increase in the compressive force for the glass up to 21% replacement at 28 days. It was observed for an intermediate concrete force with w/c of 0.4, relative to increases of 15%. The enhanced compressive strength of the concrete may indeed be attributable to the detention of crack development based on the strength of the rubber and glass in the concrete matrix. It shows that the production and forming process is not uniform and rigorous. Several analytical compression simulations had published in the literature on rubber and glass-reinforced concrete. Table 1. explains the Compressive Strength when Crumbled Rubber is used and in Table 2. Compressive Strength when Waste Glass is used is shown. In Figure 3., the Compressive Strength of the different mix Flexural Strength is shown in Figure 3. and in Figure 4. the Flexural Strength of Different mix i.e., rubber and glass concrete mixes are illustrated of over 28 days. There have been remarkable enhancements in the flexural strength in various rubber and glass lengths (50mm) and contents. CR from & WG content respectively enhanced the maximum bending strength achieved in WG and reduction in CR. The WG content has been observed to rise by 21%, which corresponds to the final load and the 6.81%. In contrast, the WG content of 17% is growing in the load, due to the deflation hardening characteristic of concrete, with increasing compression. As a result, deflection hardness behavior is increased compared to 0.2% and 0.75%. The results noted that nonlinearity could characterize the climbing section of the load-deformation curve. A bending force test of concrete using hooked steel rubber and glass. Using WG and increasing the bending strength included % WG, the researcher found significant improvement in bending forces compared to 0, 21% WG included concrete.

6.2. Relation of compressive (σ_{com}) and flexural strength (σ_f) $\sigma_f = f(\sigma_C)$

Table 3. reflects Flexural Strength when Crumbled Rubber is used & in Table 4. Flexural Strength when Waste Glass is used is shown. The coefficients were consistent for the first order and first term functions of polynomial, Fourier, Power, Exponential, and custom equation 1 to 5 with regression coefficient value greater than approximately 70%. A linear relationship between flexural and compressive strength was found for the strength of concrete with varying the content for glass and rubber. The coefficient of determination (r^2) (coefficient of variation(r)) increased 27%, and obtained values are strongly correlated in a second-order polynomial. Similar observations were obtained w.r.t first and second term Exponential, Power functions. The regression coefficients for Fourier, Gaussian, and sum of sine are 99%, 79%, and 75%, respectively, although the computations are much firmer. The data stand for Polynomial, Fourier, Power, and Exponential (two-term) functions exhibits approximately identical values, even though data sets are often stiff.

TABLE 1. **Compressive Strength when Crumbled Rubber is used.**

Mix No.	28 Days	90 Days	180 Days
CR0	33.2	41.4	58
CR4	33	35.5	40
CR4.5	30.3	34	38.2
CR5	29.1	32	35.5
CR5.5	28.2	30.5	34.5

Table 5 & 6. shows the relation of Compressive and Flexural Strength when Crumbled Rubber

TABLE 2. Compressive Strength when Waste Glass is used.

Mix No.	28 Days	90 Days	180 Days
WG0	33.2	41.4	54
WG18	35.2	43	56
WG19	36	45	58.5
WG20	37.5	46.5	60
WG21	36.2	45.5	59.5
WG22	33.9	39.5	46
WG23	31.3	37.3	41
WG24	30.4	35	40

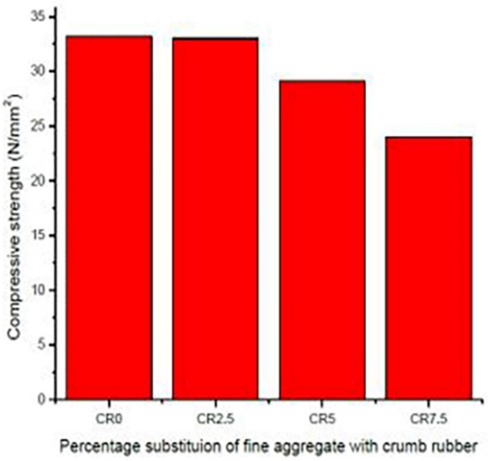

FIGURE 3. Compressive Strength of the Different mix Flexural Strength

TABLE 3. Flexural Strength when Crumbled Rubber is used

Mix No.	28 Days	90 Days
CR0	4.84	5.75
CR4	4.7	5.09
CR4.5	4.48	4.95
CR5	4.12	4.63
CR5.5	4.04	4.36

TABLE 4. Flexural Strength when Waste Glass is used

Mix No.	28 Days	90 Days
WG0	4.84	5.75
WG18	5.06	5.92
WG19	5.15	6.14
WG20	5.22	6.18
WG21	5.17	6.10
WG22	4.91	5.54
WG23	4.57	5.21
WG24	4.53	5.00

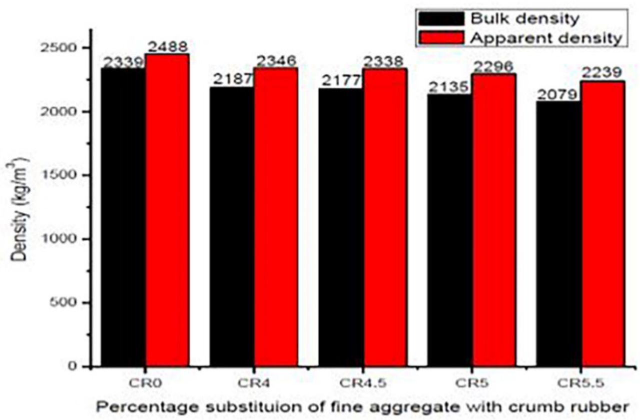

FIGURE 4. Flexural Strength of Different mix

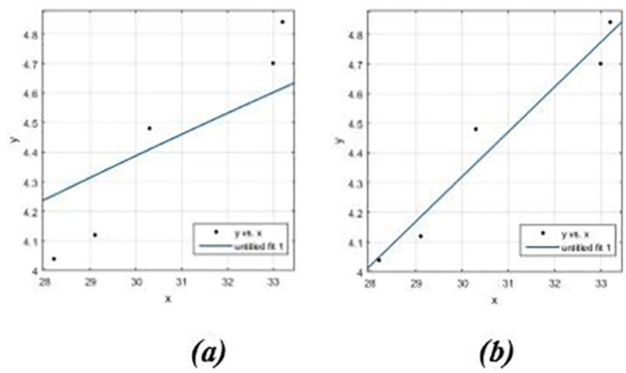

FIGURE 5. Fit of Curve (a) Poly 1st Ord (b) Root

is mixed & Waste Glass is mixed is shown. According to the code, in BIS: 456, an estimate of the flexural strength, $\sigma_f = 0.7\sqrt{\sigma_{com}}$ N/mm^2. The experimental data shows that CR & WG concrete, the estimated flexural strength obtained$\sigma_f = 0.80\sqrt{\sigma_{com}}$. & $\sigma_f = 0.84\sqrt{\sigma_{com}}$ respectively for predicted flexural intensity and BIS: 456 codes [15] the correlation coefficient elevated 14.28% & 20% for both materials. The increment might be attributed to CR&WG used in concrete. The root equation is regressive, and r^2 is 70% & 88%. The results noted that about the same determination coefficient was attained with relatively low data set constants. Root equation has less accuracy in this analysis of rubber and glass-reinforced concrete than other equations formed. Highest accuracy obtained in equation no 3 polynomial 3rd orders with determination coefficient value of 96.6% & 99.7% respectively for CR & WG. Figure 5. reflects Fit of Curve at Poly 1st Ord & Root.

TABLE 5. Relation of Compressive and Flexural Strength when Crumbled Rubber is mixed.

Functions	$\sigma_f = f(\sigma_c)$	a	b	c	r^2
Poly 1^{st} Or	f(x) = a x + b	0.15	-0.21	-	0.95
Poly 2^{nd} Or	f(x) = ax^2 + bx+c	-0.01	1.04	-13.87	0.96
Poly 3^{rd} Or	f(x) = ax^3 + b x^2 + c x + d	-0.01	1	-29.58 d=296.2	0.96
Exp 1^{st} C	f(x) = a exp (bx)	1.564	0.033	-	0.94
Exp 2^{nd}	f(x) = a exp(bx) + c exp(dx)	-0.01	0.22	0.48 d= 0.08	0.96
Fourier	f(x) = a +bcos(xd) +csin(xd)	4.40	-0.36	0.169 w = 0.66	0.96
Sine	f(x) = a sin(bx+c)	4.88	0.081	17.53	0.96
Power	f(x) = a x^b	0.12	1.045	-	0.95
Power C	f(x) = a x^b+ c	-1.23e+06	-4.058	5.618	0.96
Log C	f(x) = a log (x) +b	4.66	-11.52	-	0.95
Root	f(x) = $a\sqrt{x}$	0.80	-	-	0.70
Root C	f(x) = $a\sqrt{x}$ + b	1.67	-4.86	-	0.95
Root Inv C	f(x) = $(\frac{a}{\sqrt{x}})$ + b	-51.73	13.78	-	0.95

TABLE 6. Relation of Compressive and Flexural Strength when Waste Glass is mixed.

Functions	$\sigma_f = f(\sigma_c)$	a	b	c	r^2
Poly 1^{st} Or	f(x) = a x + b	0.107	1.259		0.982
Poly 2^{nd} Or	f(x) = ax^2 + b x + c	-0.004	0.407	-3.75	0.989
Poly 3^{rd} Or	f(x) = ax^3 + b x^2 + c x + d	-0.002	0.27	-8.88 d=101	0.997
Exp 1^{st} C	f(x) = a exp (bx)	2.33	0.022		0.978
Exp 2^{nd}	f(x) = a exp(bx) + c exp(dx)	-5.91e-17	0.948	2.09 d=0.025	0.995
Fourier	f(x) = a +bcos(xd) +csin(xd)	4.85	0.099	0.355 w = 0.367	0.997
Sine	f(x)= asin(bx+c)	5.53	0.042	12.22	0.989
Power	f(x) = a x^b	0.36	0.741		0.983
Power C	f(x) = a x^b+ c	-402.1	-1.44	7.40	0.988
Log	f(x) = a log (x)	1.40			0.613
Log C	f(x) = a log(x)+b	3.63	-7.88		0.988
Root	f(x) = $a\sqrt{x}$	0.84			0.88
Root C	f(x) = $a\sqrt{x}$ + b	1.25	-2.36		0.984
Root Inv C	f(x) = $(\frac{a}{\sqrt{x}})$ + b	-42.12	12.15		0.987

6.3. Pull off Strength

The pull-off strength increases as the WG % increases up to 22%. The rough-textured recycled aggregates are responsible for this increase in force for 28 days. he enhanced pull-off force at 28days is attributed to a more robust physical connection between hooked fibres and cement concrete. Although the surface roughness impacts may not be so substantial at a later stage when the chemical interaction between the aggregates and the paste initiates. Bending strength shows that rubber and glass-reinforced horn tensile resistance improves with rubber and glass quality empirical calculations. Thus, a more robust and higher association relation between the pull-off strength of materials was identified. Table 7 & 8. the Pull-off Strength when Crumbled Rubber is used & Waste Glass is used is detailed.

TABLE 7. Pull-off Strength when Crumbled Rubber is used

Mix No.	Pull-off strength
CR0	2.688
CR4	2.443
CR4.5	2.377
CR5	2.167
CR5.5	2.056

Table 9. shows the relation of Pull-off Strength and Compressive Strength when Crumbled Rubber

TABLE 8. Pull-off Strength when Waste Glass is used

Mix No.	Pull-off Strength
WG0	2.688
WG18	3.043
WG19	3.715
WG20	3.819
WG21	3.355
WG22	2.991
WG23	2.379
WG24	2.325

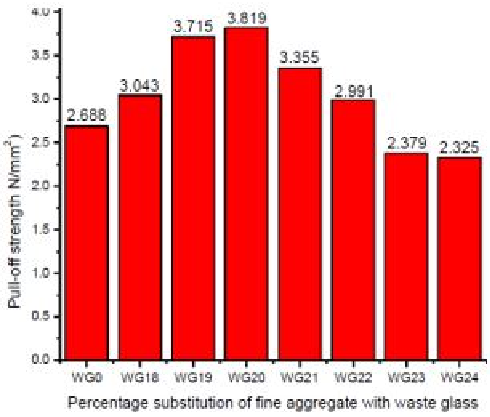

FIGURE 6. Pull-off Strength of Mix

is mixed and the correlation coefficient between splitting tensile (y-axis) and compressive intensity (x-axis) varies for distinct functions. However, the two forms of strength are still positively correlated under moderate conditions with 28 days water cured samples. It shows the best statistical functions for rubber and glass-reinforced concrete and strong correlations above 95% for proposed relations in this study.

Figure 7. shows statically Curve at Poly 1st Ord & Power and Figure 8. describes Curve Fit at Poly 1st Ord. It has been found that the determination coefficient increases among the polynomial, exponential of first and second-order/terms. The value for CR & WG for first order was 86%, & 92% and the second-order was 87% & 93% respectively for the polynomial. The result shows a difference of 1% in both cases in second-order function compared to first-order linear polynomial. The exponential provides 85% and 93% for one term with and without constant values. The power functions influence 86% & 92% in one term and 88% & 93% with constant. The enhancement of regression is 2% & 1%

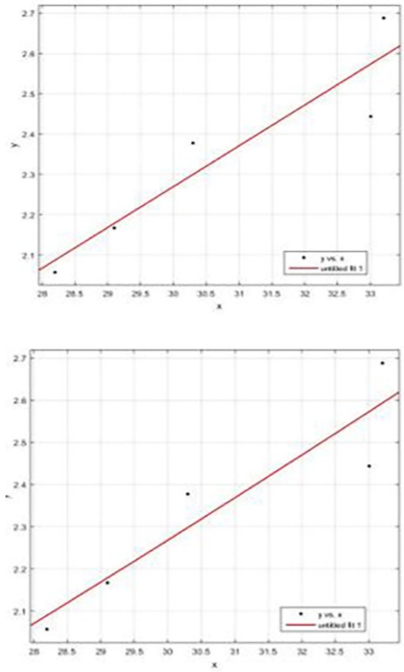

FIGURE 7. Statically Curve (a) Poly 1st Ord (b) Power

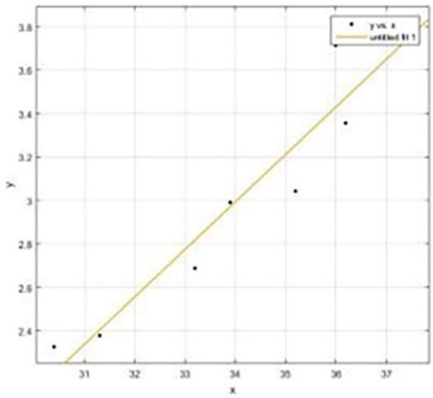

FIGURE 8. Curve Fit (a) Poly 1st Order

between the first and first terms, respectively, for CR & WG. As per the root Equation, the expected pull-off strength and the analysis yielded the following analytical expression, $\sigma_p = a\sqrt{\sigma_{com}}$ +b; while the data points are distinct, the tensile strength increases as compressive strength increases concrete increases well. For expected rubber and glass tensile strength and provided by solving the mat lab equation. The regression coefficients are 87%, 88, 86%, and 87%for Fourier, sine, log, and root inverse.

TABLE 9. Relation of Pull-off Strength (σ_p) and Compressive Strength (σ_{com})when Crumbled Rubber is mixed

Funct.	$\sigma_p = f(\sigma_c)$	a	b	c	r^2
Poly 1^{st} Or	f(x) = a x + b	0.101	-0.772		0.86
Poly 2^{nd} Or	f(x) = ax^2 + b x + c	-0.011	0.819	-11.81	0.877
Poly 3^{rd} Or	f(x) = ax^3 + b x^2 + c x + d	0.014	-1.293	39.81 d= -406.5	0.89
Exp 1^{st} C	f(x) = a exp (bx)	0.626	0.042		0.85
Exp 2^{nd}	f(x) = a exp(bx) + cexp(dx)	0	-1.82	0.626 d= 0.042	0.85
Four.	f(x) = a + b cos(xd) +c sin (xd)	-1.0e+5	1.02e+5	1719 w = 4.77e+4	0.87
Sine	f(x) = a sin (bx+c)	2.617	0.100	16.96	0.88
Pow.	f(x) = a x^b	0.0251	1.323		0.86
Pow.C	f(x) = a x^b+ c	-3.3e8	-5.917	2.904	0.88
Log C	f(x) = a log (x) + b	3.129	-8.369		0.86
Root C	f(x) = $a\sqrt{x}$ + b	1.127	-3.899		0.86
Root Inv C	f(x) = ($\frac{a}{\sqrt{x}}$) + b	-34.74	8.62		0.87

TABLE 10. Relation of Pull-off Strength and Compressive Strength when Waste Glass is mixed

Funct.	$\sigma_p = f(\sigma_c)$	a	b	c	r^2
Poly 1^{st} Or	f(x) = a x + b	0.218	-4.443		0.92
Poly 2^{nd} Or	f(x) = ax^2 + b x + c	0.013	-0.676	10.64	0.93
Poly 3^{rd} Or	f(x) = ax^3+bx^2+c x+d	-0.003	0.329	-11.42 d=131.7	0.93
Exp 1^{st} C	f(x) = a exp (bx)	0.231	0.075		0.93
Exp 2^{nd}	f(x) = a exp(bx) + c exp (dx)	-1.66e+12	-1.00	0.188 d= 0.080	0.93
Fourier	f(x) = a + b cos(xd) + c sin(xd)	3.289	0.361	-0.919 w = 0.276	0.93
Sine	f(x) = a sin (bx+c)	49.92	0.004	12.49	0.91
Power	f(x) = a x^b	3.7e-04	2.546		0.92
Power C	f(x) = a x^b+ c	6.05e-08	4.836	1.384	0.93
Log C	f(x) = a log (x) + b	7.350	-22.91		0.91
Root C	f(x) = $a\sqrt{x}$ + b	2.537	-11.80		0.91
Root Inv C	f(x) = ($\frac{a}{\sqrt{x}}$) + b	-85.07	17.61		0.90

7. Relations concerning Pull-off Strength (σ_p) and Flexural Strength (σ_f)

The objective of Table 10 σ_{com}ummarises the Relation of Pull-off Strength (σp) σ_fnd $\sigma_p = f \ (\sigma_c, \sigma_f)$ompressive Strength ($\sigma$_com) and its mathematical expectations to provide a correlation of regression employing soft computing for experimental analyses. The goodness of the correlation within a test series of proposed relations corresponding polynomial, Fourier, power, exponential, sine, log, root, and inverse root equation constellations are over 97%. The flexural force and pull-off strength of rubber and glass specimens are predicted with these equations. The linear and quadratic polynomial obtained 94% & 89% and 95% & 93% of correlation, respectively, for CR & WG and observed that coefficient of determination increases, polynomial order provides strong correlation. Exponential and power functions show a similar linear polynomial function; the regression coefficients for Fourier and sine were 95% & 93%, 94% & 89%. The equation and the predicted data constants were many complexes. Root & inverse root equations show that regressive value gained 94% & 89% to 94% & 88% respectively for CR & WG and constellations were less insignificant.

8. Relation of Compressive (σ_{com}), Pull-off Strength (σ_p) and Flexural Strength (σ_f) $\sigma_p = f \ (\sigma_c, \ \sigma_f)$

The goodness of the correlation within a test series of proposed relations corresponding polynomial, Fourier, power, exponential, sine, log, root, and inverse root equation constellations are over 97%.

The flexural force and pull-off strength of rubber and glass specimens are predicted with these equations. The linear and quadratic polynomial obtained 92% & 93% and 93% & 95% of correlation, respectively, for CR & WG and observed that coefficient of determination increases, polynomial order provides strong correlation. Exponential and power functions show a similar linear polynomial function, the regression coefficients for sine were 70% & 94%, while the equation and the predicted data constants were many complexes.

9. Conclusion

Based on the results of the experiments carried and mathematical analysis on both of the two mixes following conclusion can be carried out: When the percentage of crumbled rubber increases, then compressive strength will deduce but minimal amount. When the percentage of waste rubber increases up to 21%, then compressive strength will increase. It was found that with increases CR (%), the flexural strength is deducing. Nevertheless, with an increase in the WG (%) up-to-the 22 %, flexural strength increases. With increasing the CR (%), the pull-off strength is deducing. But with an increase in the WG (%) up-to-the 22 %, then flexural strength increases.In the case of the mathematical equation, the polynomial equation is most of the cases best fitted. Polynomial 2^{nd} order equation shows the highest accuracy. Other equations like root, root C, inv root, log, and sine power also show good accuracy. According to the code, in BIS: 456 [24], an estimate of the flexural strength, $\sigma_f = 0.7\sqrt{\sigma_{com}}$ N/mm^2. The experimental data shows that CR & WG concrete, the estimated flexural strength obtained $\sigma_f = 0.80\sqrt{\sigma_{com}}$. & $\sigma_f = 0.84\sqrt{\sigma_{com}}$, which shows that flexural strength improved after the addition of waste.

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