JOURNAL OF CRITICAL REVIEWS

ISSN- 2394-5125 VOL 7, ISSUE 04, 2020

Forcasting on Mechanical Characteristics of Slurry Infiltrated Fibrous Concrete (SIFCON) using Math Cad

P.Sampath[1] and Dr.P.Asha[2]

[1]Research scholar, Dept. of Civil Engineering, St.Peter's Institute of Higher Education and Research, Avadi, Chennai, Tamil Nadu, India, sampathp1984@gmail.com.

[2]Professor, Dept. of Civil Engineering, St.Peter's Institute of Higher Education and Research, Avadi, Chennai, Tamil Nadu, India, ashap1905@gmail.com.

Received: 14 Feb 2020 Revised and Accepted: 25 March 2020

ABSTRACT: In this research, Math cad software tool is applicable for forecast the mechanical behavior of SIFCON consisting of steel fibres plus Silica Fume (SF) as alternate cement substitute correspondingly. This information behave in the sculpt structure were got it from lab tests. The mechanical behavior were practically find for molds consisting of 0%, 5%, 15%, 25% and 35% volume portion of steel fibres plus 15% SF as part of cement replacing @ hardening periods of 28 days, explanation of a overall of 200 notice. This several bulk portions were filled as the constituent invariable to succeed this mechanical belongings as the goal area. This Math cad tools incontestible more quality and had greater parametric statistic. In the tools of the preparation and investigating outcomes have represent that Math cad have powerful possibility for guessing 28th days compression, splitting tension and flexure capability beliefs of SIFCON incorporating silica fume..

KEYWORDS: Math cadd, Forecasting, Mechanical Characteristics, Steel Fibres, Sifcon.

I. INTRODUCTION

Natural tragedy like seismic effect will originate the heavy change in structures & construction which creates the failure in humanlike livings, economic system & environment solution. Improvement in lengthwise & transversal strengthen was innovate in overwhelm breakable destiny in the shaft which is the leading drawback in the heavily strengthened segment. By supplying larger quantity of lateral pass reinforcing stimulus in the over strengthened segment will aid to addition the ductile properties of the unit. Finally, it is most essential to grow innovative categories of strral elements which use the substantial which will improve the ductile properties of the structural elements. Adding fibres in SIFCON is not a innovative message it lead to helps in alteration of constituent character to make breakable into unbreakable. This ductileness in structural element trust in kinds of constituents utilized & structures behaviour in the construction. Always attention is must in design, this is manageable in construct yielding construction plus strengthened SIFCON thus allowing this to change solidly no change of integrity. The unbreakable structural element leads to change inflexible when this is dependent in overburden, this will spread in extra loading in elasticised environments in sconstruction (Rajaram et.al., 2018).

An ancient period horse hair and straw were the fibres utilized for clay blocks. Future in 1900s, asbestos fabric were utilized in SIFCON & in the 1950s the idea for utilising compound resources and fabric strengthened SIFCON were utilised. In 1960s, steel fabric reinforcement (strengthened) composite (SFRC). SIFCON innovate in the year 1983 by Lankard(USA). The concrete pertain fabric of various dimensions of steel fibres in various bulk portion. This is approvable to utilize many kinds of fibres in SIFCON as per American Concrete Institute (ACI) handbook of concrete exercise. Reduction in empirical challenge creates improvement in programmable system it will foretell those characteristics of the SIFCON in current academic (Atici 2011). Representations have been developed by utilize these programme system and quadratic and cubical equations were also derivable in forecast the engineering characteristics (Palika et.al., 2014). Creating of representations by Regression investigation is one of the traditionalistic method acting engaged in prototypical group (Muhd et.al., 2015). Easyest & fastest forecasting were the better benefit of reversion examination. Several regression will be achieved in the quality in prototypical (Ferhat et.al., 2013). For acting several reversion the quality of the prototypical can be improved (Marek Slonski 2010).

Addition of amount in self-directed variant will outcome in the reduction in the quality of reversion analytic thinking (Sadrmomtazi 2013). At this difficult belongings, this usage in method acting suchlike Mock Neural Systems (Ramana et.al., 2009), accommodative neuro uncertain reasoning methods, factorial pattern, genetical supported algorithmic rule, kind tree diagram and uncertain principle (Ahmet et.al., 2013; Rahmat et.al., 2012;

Tortum et.al., 2009) are engaged in modify this quality in forcasted replicas. Replicas are improved by MATH CAD programme system (Ravichandran et.al., 2009) in instruction to forcast the powered characteristics in concrete molds & the outputs of all models are correlated with each other. MATH CAD permits matrix work, plotting of mathematical function and information, execution in algorithmic rule, initiation for exploiter operator interface, and interfacing with agendas printed in another communication, considering C, C++, C#, Java, Fortran and Python. Eventhough MATH CAD is intentional principally for numeric computation, an elective tool cabinet utilizes the MuPAD symbolical cause, allowing way to symbolic computation qualities. In this investigation, the mechanical charecteristics of control mix (SIFCON without fibre) is consider as the reliant on mutable, whereas, steel fibre capacity portion for the self-governing variables. This aim for investigation are develop predicted replicas for the forcasting of compression study, split tension study and bending study of SIFCON plus silica fume.

II. MATERIALS & METHODS

2.1 Material & mix proportion

Ordinary Portland Cement 53 grade for remark to IS 12269-2013 by a specific gravity is 3.15 was utilised for SIFCON mix. Fine aggregate pass through 1.18 milli meter siever with remark to zonal catogary of IV in IS 383:1970 in the specific gravity of 2.6 was utilised as sand for our investigation. The length of steel fibre is 35mm with diameter of 0.5mm. The length to diameter ratio of 70 for steel fiber were kept uniform. 4 different volume proportions (0%, 5%, 15%, 25%, and 35%) of SIFCON with 15% Silica Fume (as a additional of cement) were utilised in our research.

2.2 Mixing & curing

The consolidated mix design of SIFCON has been processed in remark of Y.Farnam et.,al., (16). This ethics for the mixture percentage and water /cement are shown in the table 1,2 & 3. The SIFCON is processed in similar for formal SIFCON. Initially cement, sand & silica fumes are blended in a dehydrated condition dry mix for other 60 seconds. Steel fibres were placed into the specimen. At final, the pure H_2O was additional to the dehydrated mix & the mix was done in an suitable mode for sustain in running of cement mortar slurry to steel fibre is homogenous. Afterward compounding, the SIFCON was settled in five relation in block. All part of SIFCON was tamped at a range of 60 to 80 physical tamping using tamping rod of 16mm diameter and also table movement of 2minutes. A cumulative of 468 molds were prepared and de-form after 24 hours. Afterwards the preserving stage of 28 days, all the molds were investigated.

Table 1 Mixture Percentage

Grade	Mixture Percentage (1m^3)	Water cement Ratio
M20	Cement: Silica fume: Fine Aggregate: Water 1:0.175:0.835:0.388	0.33

Table 2 SIFCON MIX PROPORTION for 1m^3

Mix	W/C	Water kg/m^3	Cement Portland (Type I-OPC-53 Grade) kg/m^3	Silica Fume 15% replace ment kg/m^3	Fine Aggregat e less than 1.18mm kg/m^3	Superplasticiz er Polycarboxyla te Eather(CBS brand) 1.4% of cementitious material by mass kg/m^3	Volum e Fractio n Vf	Steel Fibre Content kg/m^3
Ref	0.33	388	1000	175	835	16.45	0	0
PMSF-5	0.33	388	1000	175	835	16.45	5	58.75
PMSF-15	0.33	388	1000	175	835	16.45	15	176.25
PMSF-25	0.33	388	1000	175	835	16.45	25	293.75
PMSF-35	0.33	388	1000	175	835	16.45	35	411.25
HEMSF-5	0.33	388	1000	175	835	16.45	5	58.75
HEMSF-1 5	0.33	388	1000	175	835	16.45	15	176.25
HEMSF-2	0.33	388	1000	175	835	16.45	25	293.75

5								
HEMSF-35	0.33	388	1000	175	835	16.45	35	411.25
CMSF-5	0.33	388	1000	175	835	16.45	5	58.75
CMSF-15	0.33	388	1000	175	835	16.45	15	176.25
CMSF-25	0.33	388	1000	175	835	16.45	25	293.75
CMSF-35	0.33	388	1000	175	835	16.45	35	411.25

PMSF-Plain Mild Steel Fibre**, HEMSF-** Hooked End Mild Steel Fibre**, CMSF-** Crimped Mild Steel Fibre

2.3 Compression Value

For the calculation of compression force character in formal & SIFCON, the compressive strong point was found. This cube molds were arranged and investigated by remark to IS: 516-1959. The size of the cube is 70 × 70 ×70 milli meter were cast and preserved for 28 days to become the compression value at 28 days. The cubes molds remained investigated in the soaking exterior dehydrated state & the force was useful progressively to invention the ultimate force booming bulk of the cube molds.

2.4 Split tension value

To find the split stretchy force character of control and SIFCON, the divided stretchy strong point was originate. The size of tubular samplings fit of 75mm dia & 150mm height were casted and placed in preserving for 28 days. The assessment was attended on cylindrical specimen at the curing age of 28 days end confirming to IS: 5816-1970. The ultimate force was recorded in divided stretchable value to all control & SIFCON.

2.5 Flexural Value

To calculate the bending value for control and SIFCON the bending value was found. The prism cases were processed & investigated by relevence to IS: 516-1959. The size of the prisms is 75 × 75× 305 mm were cast and placed for curing for 28 days to obtained the flexural value at 28 days. The prisms was investigated underneath 2 point loading test in the UTM & the force was functional progressively to invention the ultimate force carrying volume of the prism underneath flexure. The powered belongings of the SIFCON with silica fume was specified in Table 3.

Table 3. Mechanical Behaviour of the SIFCON plus Silica Fumes

Mixture	Compression value MPa	Compression value	Split Tensile value MPa	Split Tensile value	Flexural value N/ MPa	Flexural value
Details	28Days Strength	Strength Effectiveness(%)	28Days Strength	Strength Effectiveness(%)	28Days Strength	Strength Effectivenes s(%)
Ref	22.85	0	2.48	0	4.05	0
PMSF-5	31.02	35.75	3.57	43.95	6.31	55.80
HEMSF-5	28.30	23.85	4.23	70.56	7.28	79.75
CMSF-5	28.30	23.85	2.54	2.42	4.91	21.23
PMSF-15	36.42	59.39	4.16	67.74	18.98	368.64
HEMSF-15	29.30	28.22	4.52	2.26	21.81	604.94
CMSF-15	29.59	29.50	3.96	59.68	19.33	377.28
PMSF-25	40.31	76.41	5.39	117.34	30.55	654.32
HEMSF-25	31.40	37.42	5.50	121.77	47.98	1084.69
CMSF-25	38.77	69.67	5.26	112.10	29.07	617.78
PMSF-35	42.08	84.16	5.66	128.23	27.13	569.88
HEMSF-35	35.50	55.36	5.67	128.63	20.92	416.54
CMSF-35	54.08	136.67	6.79	173.79	41.96	936.05

Adition of steel fibres helps to improves in strong point effectiveness of the SIFCON. The compression, divided tension and bending value was improved at all fiber capacity percentage with related to the control concrete mixture. The ultimate strong point efficiency in compression value is 136.67% which is happened at mixture CMSF-35. For divided stretchable value, the SIFCON has got its ultimate strength powerfulness at mixture CMSF-35 is 173.79%. For all compression and divided tension value, the strong point powerfulness have achieved at the same mix proportion. But for the flexural value the strength powerfulness gotten its ultimate value at HEMSF-25 is 1084.69%. MATH CAD is a multi-paradigm quantitative computation environs and proprietorship scheduling communication formed by Math works. It is a elevated communication and interactional environs for numeric calculation, imagining & planning. Using MATH CAD, you can examine information, create algorithmic rule, and act models and concern. The communication, instruments, and inbuilt math usefulness modify you to investigate multiple formulation and reaching a result quicker than with computer program or traditionalistic planning languages, such as C/C++ or Java. MATH CAD is utilized for a array of utilization, plus signaling process & communication theory, picture & movie recording process, controller conditions, mental exam and dimension, computational economics, and computational biological science. Additional than a million engineers and experts in business enterprise & academe usage MATH CAD, the communication of methodological computation. For our investigation, the proposal has been shaped by Math cad & the equations were also formed to foretell the powered belongings of SIFCON incorporate steel fibres & silica fumes.

III. Results & Discussions

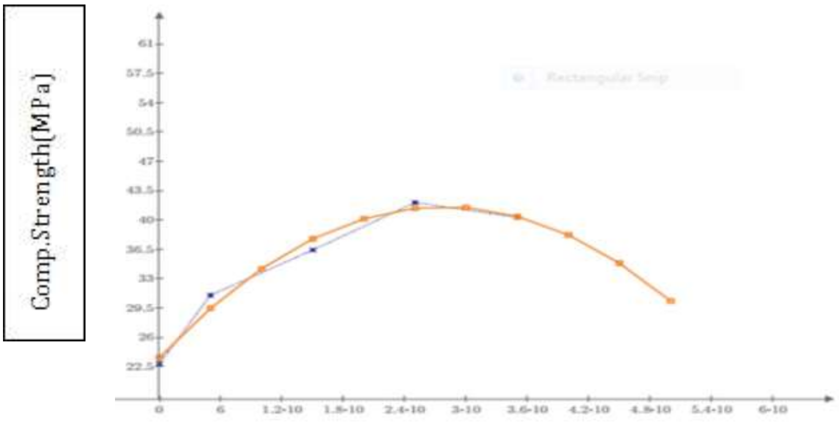
3.1 Compression Value

Math cad was utilised to foretell the compression value of the SIFCON incorporating SIFCON plus silica fume. A system of rules was inscribed to secret plan the diagram among the empirical beliefs & steel fibre bulk segments. The steel fibre bulk portion has kept back as self-directed variant of foretell in compression values at the SIFCON. Constructed on the tracking & option for quadratic equation the expected curvature has been created in this Math cad which is given in the Figure 1. Based on the expected arc the compression value of the SIFCON was expected by just subbing the comparative steel fiber volume portions. The expected belief with their related forecasting mistake were given in Table 4. Supported on the solutions, the mean forecasting mistake is 1.43% which displays a great copulation amongst the data-based and expected belief. The quadratic equations were too improved for the advanced forecasting by ever-changing the steel fibre bulk segments. The constant of the quadratic equations with their belief are specified as $Y= -0.017\ x^2+1.109x+24.042$ for Plain Mild Steel Fibres (PMSF), $Y=-0.002\ x^2+0.38x+24.288$ for Hooked End Mild Steel Fibres (HEMSF) and $Y=0.023\ +0.036x+24.669$ for Crimped Mild Steel Fibres (CMSF).

Table 4 Forecasted values for Compression value

Mixture	Steel Fibre Bulk Rational (%)	Empirical Values N/mm^2	Expected Values N/mm^2	Forcasting mistake in %
Ref	0	22.85	21.367	-6.49
PMSF-5	5	31.02	32.883	6.01
PMSF-15	15	36.42	36.045	-0.01
PMSF-25	25	40.31	39.641	-0.02
PMSF-35	35	42.08	42.452	0.01
HEMSF-5	5	28.30	30.466	7.53
HEMSF-15	15	29.30	29.093	-0.01
HEMSF-25	25	31.40	30.348	-0.03
HEMSF-35	35	35.50	36.030	1.49
CMSF-5	5	28.30	31.185	10.19
CMSF-15	15	29.59	28.894	-0.02
CMSF-25	25	38.77	37.874	-0.02
CMSF-35	35	54.08	54.606	0.01
			Mean	1.43

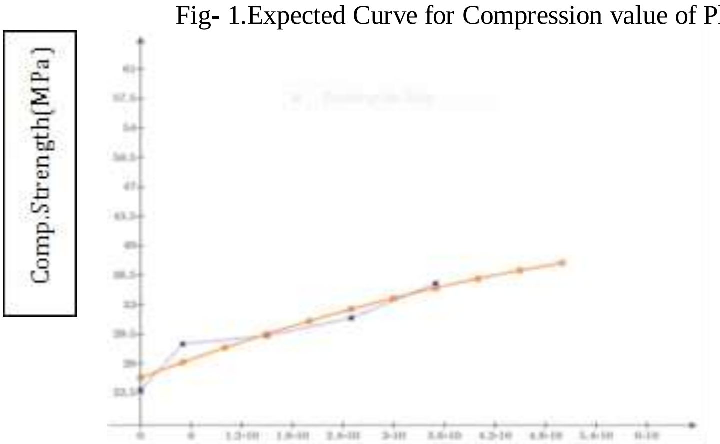
ISSN- 2394-5125 VOL 7, ISSUE 04, 2020



PMSF Bulk Portion

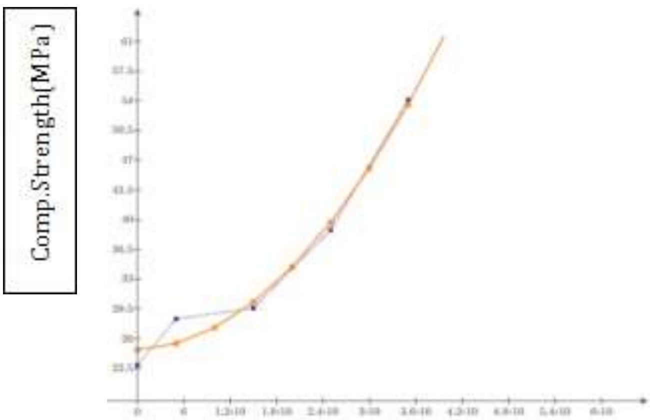
Yellow - Expected values, Blue -Empirical Values

Fig- 1.Expected Curve for Compression value of Plain Mild Steel Fibre (PMSF)



HEMSF Volume Fraction

Fig- 2. Expected Curve for Compression value of Hooked End Mild Steel Fibre (HEMSF)



CMSF Volume Fraction

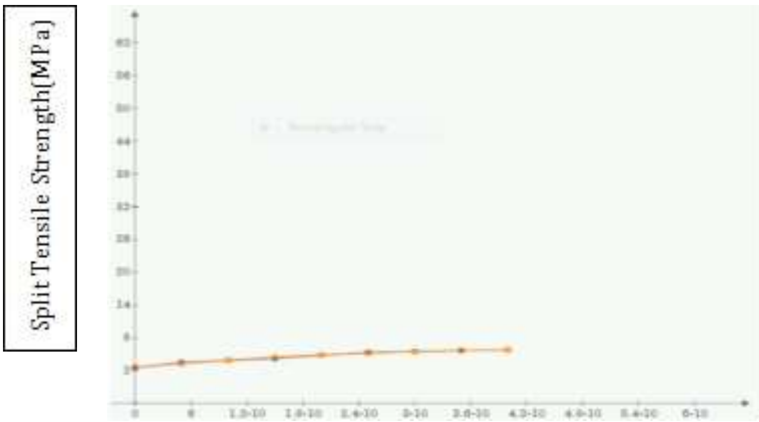
Fig- 3. Expected Curved shape for Compression value of Crimped Mild Steel Fibre (CMSF)

3.2 Split Tensile value

To foretell the split tensile value of the concrete carrying steel fibers with silica fume, Math cadd was utilised. In the math cad an algorithmic rule was shaped to tract the diagram among the empirical belief & steel fibre bulk portion. The steel fibre bulk portion was kept as self-directed variant to foretell the divided stretchable value which is a reliant on variant for the forecasting. Constructed on the secret plan and option of quadratic equation the expected arc has been produced in the Math cad as given in the Figure 2. Based on the expected ard the divided stretchable value of the SIFCON has been expected by just subbing the relational steel fibre bulk portion. The expected belief with their proportionate forecasting mistake were shown in Table 5. Constructed on the outcome, the mean forecasting mistake is 3.31% which gives a great relative amongst the empirical & expected belief. The quadratic equations were also improved for the additional forecasting by ever-changing the steel fibre bulk part. By utilising that quadratic equation the divided stretchable value of the SIFCON was expected. The quadratic equations with their related to constant belief were presented as $Y= -0.002\ x^2+0.147x+2.606$ for PMSF, $Y=-0.003x^2+0.174x+2.824$ for HEMSF and $Y=0.001x^2\ +0.083x+2.334$ for CMSF.

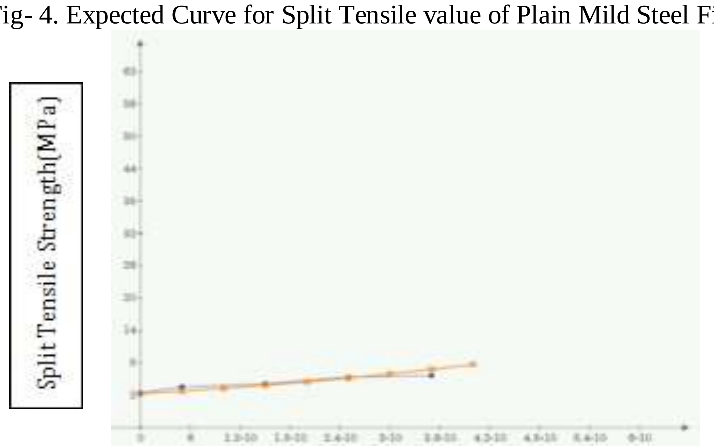
Table 5. Expected belief for Split Tensile value

Mix	Steel Fibre Bulk Portion (%)	Empirical Belief N/mm^2	Expected Belief N/mm^2	Forecasting Mistake in %
Ref	0	2.48	2.372	-4.35
PMSF-5	5	3.57	3.843	7.65
PMSF-15	15	4.16	4.433	6.56
PMSF-25	25	5.39	5.55	2.97
PMSF-35	35	5.66	5.622	-0.01
HEMSF-5	5	4.23	3.886	-8.13
HEMSF-15	15	4.52	4.465	-1.22
HEMSF-25	25	5.50	5.395	-1.91
HEMSF-35	35	5.67	5.701	0.01
CMSF-5	5	2.54	3.327	30.98
CMSF-15	15	3.96	4.247	7.25
CMSF-25	25	5.26	5.431	3.25
CMSF-35	35	6.79	5.628	-17.11
			Mean	3.31



PMSF Volume Fraction

Fig- 4. Expected Curve for Split Tensile value of Plain Mild Steel Fibre (PMSF)



HEMSF Volume Fraction

ISSN- 2394-5125 VOL 7, ISSUE 04, 2020

Fig- 5. Expected Curve for Divided Stretchable Strong point of Hooked End Mild Steel Fibre (HEMSF)

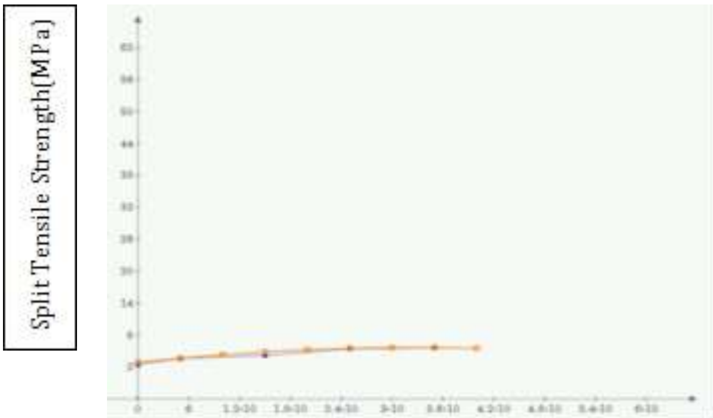


Fig- 6. Expected Curve for Divided Stretchable Strong point of Crimped Mild Steel Fibre (CMSF)

3.3 Flexural value

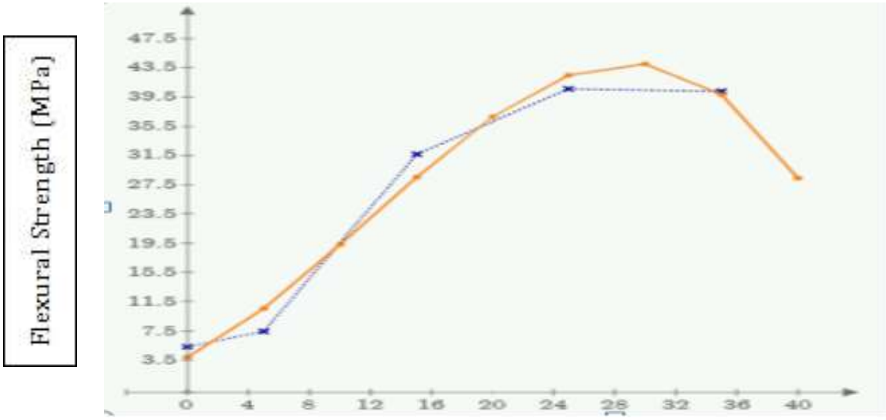
Flexural value of the SIFCON comprising steel fibres with silica fume was expected with the utilise of the Math cad tooled program. A system was in writing to draw the plot among the empirical belief & steel fiber bulk portions. The steel fiber bulk portion has kept as self-directed variant to foretell the flexural value. Constructed on the tracting and option of quadratic equation a arc was produced to foretell the flexural value in the Math cad as given in the drawing 3. Basedon the forecasted arc the flexural value of the SIFCON was expected by just subbing the relational steel fibre bulk portions. The expected belief with their related to forecasting mistake were given in Table 6. From the outcomes, the mean forecasting mistake is 1.83% which gives a excellent abstraction among the empirical and expected belief. The quadratic equations were also improved for the advance forecasting on flexural quantity by altering the steel fiber bulk portions. The constants of the cubiform equations with their related to beliefs were given as $Y=-0.002x^3+0.1x^2+0.017x+4.038$ for PMSF, $Y=-0.006x^3+0.261x^2-0.8x+4.523$ for HEMSF and $Y=-0.001x^3+0.034x^2+0.556x+3.198$ for CMSF.

Table 6. Expected belief for flexural values

Mix	Steel Fibre bulk portion (%)	Emperical Flexural Values N/mm^2	Expected Values N/mm^2	Expected Mistakes in %
Ref	0	4.05	4.781	18.04
PMSF-5	5	6.31	6.284	-0.004
PMSF-15	15	18.98	19.006	0.001
PMSF-25	25	30.55	30.534	-0.0005
PMSF-35	35	27.13	27.134	0.0001
HEMSF-5	5	7.28	8.314	14.20
HEMSF-15	15	28.55	27.516	-3.62
HEMSF-25	25	47.98	48.601	1.29
HEMSF-35	35	20.92	21.335	1.98
CMSF-5	5	4.91	3.047	-62.06
CMSF-15	15	19.33	21.193	9.64
CMSF-25	25	29.07	27.952	-3.85
CMSF-35	35	41.96	42.226	0.63
			Mean	1.83

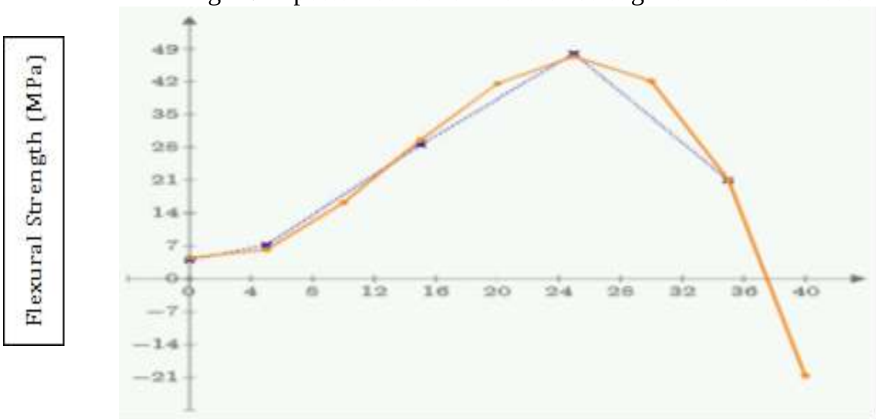
JOURNAL OF CRITICAL REVIEWS

ISSN- 2394-5125 VOL 7, ISSUE 04, 2020



PMSF Volume Fraction

Fig- 7. Expected Curve for Flexural Strength of Plain Mild Steel Fibre(PMSF)



HEMSF Volume Fraction

Fig- 8. Expected Curve for Flexural Strength of Hooked End Mild Steel Fibre (HEMSF)

CMSF Volume Fraction

Fig- 9. Expected Curve for Flexural Strength of Crimped Mild Steel Fibre (CMSF)

IV. CONCLUSIONS

In the replicas builted in Math cad, a quadratic and cubical equations with this primary accessory was utilized. The replicas were improved with steel fibre portion as involvement information & the related to capability as end product information. Only by utilising the contribution information in the Math cad the 28 days compression, split tension and flexural behaviour of SIFCON including silica fume were found. The values are nearer to the emparical outcomes collected from curve produced in the Math cad. As a outcome, compression & split stretchable strength and flexural strengths of SIFCON comprising silica fume can be expected in Math cad without attending any investigations in a fairly quick dated of time with minimum mistake charges. The received think have given that Math cad has the potentiality to foretell the powered characteristics of SIFCON. The mean expected percent of mistake for compression value 1.43%, for splitting tensile value 3.31% and for flexural value 1.83%.

V. REFERENCES

[1] Ahmet Raif Boga., Murak Ozturk., Ilker Bekir Topcu. (2013). "Using ANN and ANFIS to predict the mechanical and chloride permeability properties of concrete containing GGBFS and CNI." Compos. Part B 45 (2013) pp.688–696, DOI: 10.1016/j.compositesb.2012.05.054.

[2] Atici, U. (2011). "Prediction of the strength of mineral admixture concrete using multivariable regression analysis and an artificial neural network". Expert Syst. Appl. 38, pp.9609–9618, DOI: 10.1016/j.eswa.2011.01.156.

[3] Ferhat Bingol, A., Ahmet Tortum., Rustem Gul. (2013). "Neural networks analysis of compressive strength of lightweight concrete after high temperatures." Mater. Des. 52, pp.258–264, DOI: 10.1016/j.matdes.2013.05.022.

[4] Marek Slonski. (2010). "A comparison of model selection methods for compressive strength prediction of high –performance concrete using neural networks." Comput. Struct. 88, pp.1248–1253, DOI:10.1016/j.compstruc.2010.07.003.

[5] Muhd Fadhil Nuruddin., Sadaqat Ullah Khan., Nasir Shafiq., Tehmina Ayub. (2015). "Strength prediction models for PVA fiber – reinforced high – strength concrete." J. Mater. Civ. Eng. 27 (12), pp.2–16, DOI: 10.1061/(ASCE) MT.1943-5533.0001279.

[6] Palika Chopra, R.K., Sharma., Maneek Kumar. (2014). "Regression models for the prediction of compressive strength of concrete with and without fly ash." Int. J. Latest Trends Eng. Tech. 3 (4), pp.400–406.

[7] Rahmat Madandoust., John. H., Bungey., Reza Ghavidel. (2012). "Prediction of the concrete compressive strength by means of core testing using GMDH – type neural network and ANFIS models." Comp. Mater. Sci. 51, pp.261–272, DOI:10.1016/j.commatsci.2011.07.053. [30]

[8] Rajaram, M., Ravichandran, A., Muthadhi, A. (2018). "Studies on Hybrid Fiber Concrete with GGBS." International Journal of Pure and Applied Mathematics, Volume 119, Issue 12, ISSN No: - 1314 – 3395, pp.581-595.

[9] Rajaram, M., Ravichandran, A., Muthadhi, A. (2017). "Studies on Optimum Usage of GGBS in Concrete." International Journal of Innovative Science and Research Technology, Volume 2, Issue 5, ISSN No: - 2456 – 2165, pp.773-778.

[10] Ramana, K.V.S., Anita, T., Mandal, S., Kaliappan, S., Shaikh, H., Sivaprasad, P.V., Dayal, R.K., Khatak, H.S. (2009). "Effect of different environmental parameters on pitting behaviours of AISI type 316L stainless steel: experimental studies and neural network modelling." Mater. Des. 30, pp.3770–3775, DOI: 10.1016/j.matdes.2009.01.039.

[11] Ravichandran, A., Suguna, K., and Ragunath, P,N. (2009). "Strength Modelling of High Strength Concrete with hybrid fibre Reinforcement." American Journal of Applied Sciences, Volume 6, Issue 2, ISSN No: - 1546 – 9239.

[12] Sadrmomtazi, A., Sobhani, J., Mirgozar, M, A. (2013). "Modeling compressive strength of EPS lightweight concrete using regression, neural network and ANFIS." Constr.Build. Mater. 42, pp.205–216, DOI: 10.1016/j.conbuildmat. 2013.01.016.

[13] Tortum, A., Yayla, N., Gokdag, M. (2009). "The modeling of mode choices on intercity freight transportation with the artificial neural networks and adaptive neuro fuzzy inference system." Expert Syst. Appl. 36 (3) pp.6199–6217, DOI:10.1016/ j.eswa.2008.07.032.

[14] Rajaraman, Ravichandran, Muthadhi (2018). "Prediction on Mechanical Properties of Hybrid Fibre Concrete using MATLAB." International Research Journal of Engineering and Technology, Vol:5, Issue:7,e-ISSN:2395-0056, P-ISSN:2395-0072.

[15] Jayashree.S.M, Rakul Bharatwaj, Dr.Helen Santhi (2013). "Flexural Behaviour of SIFCON Beams." International Journal of Engineering research and Technology." Vol.2, Issue:2, ISSN:2278-0181.

[16] Y.Farnam et.,al., (2010). "Behaviour of SIFCON under triaxial compression" Cement and Concrete Research 40, pg.1571-1581.