MECHANICAL AND DURABILITY BEHAVIOR COMPARISION AND FINDING OPTIMAL FIBER REINFORCED CONCRETE.

by S.T. SANTHOSH KUMAR

ABSTRACT

Finding the Best Quality Fiber Reinforced Concrete is essential task in a Concrete Manufacturing Industry. which require lot of Observational Data. Performing Comprehensive analysis on Statistical Data which has data regarding Mean and Standard Deviation. Descriptive Analytical Model is used to extract the optimal Mixture from the Statistical Data. Using Data Analysis and Manipulation tool (Pandas-Python) to perform comparision and analysis to find Optimality. Comparing all the mixes with other available mixes to find the Optimal Fiber Reinforced Concrete in all stages of water Curing (28 days), Heat-cool cycles (6 months) and Wet-Dry cycles (6 months).

INTRODUCTION

This Documentation describes about the analytical Research performed on Mechk Fibre Reinforced Concrete. Statistical Data which describes Compressive Strength of each mixture having Average MPa and Standard Deviation of all mixes and its specimens.

Literature:

The Observations from 28 days water curing process, 6 months wet-dry Cycles and 6 months Heat-cool cycles provides statistical Data which are average MPa and Standard Deviation of all Specimens of mixes. There are particularly 3 types of Fibers used which are Steel Fibers, Date Palm Fibers, Polypropylene Fibers are used in 0.2, 0.6 and 1.0 volume fractions results in different observations. Water Curing is process of Hardening Concrete by treatment of Water.

Background:

→ Each Mixture is made up of same quantity components except fibres and its volume fractions. Comparing every mixture with all mixes. The positive difference indicates better and negative difference indicates worse. From the observations and calculations, we get the result of which mixture is optimal in all mixes, we can calculate the overall optimal mixture which is better suitable for all the conditions.

Objective:-

Main objective is to research, study and understand the effect of 3 different Fibres in ordinary Concrete under cyclic exposure of heat-cool and Wet-Dry and develop Analytic Model.

EXPERIMENTAL PROGRAM:-

The Objective of the experimental program was to compare all every mix with all mixes at 28 days water curing. 6m heat-cool and Wet-dry Cycles and develop descriptive analytical model.

The Experimental Program concentrated on following

* Comparing all the mixtures with other mixes at 28 days water Curing.
* Comparing all mixes at 6 months Heat-Cool Cycles.
* Comparing all mixes at 6 months Wet-Dry Cycles.
* Finding optimal mixes in every cycle and overall.

Comparing all mixtures with other mixes at 28 days water Curing:-

→ Arrange all Data available in Dataframe.

→ Completing all Data clensing process in order to validate the Dataset.

→ Comparing No mix with other mixes, and all the mixes with other mixes.

→ Computing overall score of each mix by considering the comparision values and Standard Deviation.

Comparing all mixes at 6 months Wet-Dry Cycles:

→ Arrange all the Data available in a Dataframe
→ Completing all Data cleansing process in order to validate the Dataset.
→ Comparing Mo mix with other mixes and all the mixes with other mixes.
→ Computing overall score of each mix by comparing values.

Comparing all mixes at 6 months ~~Heat-Cool~~ Cycles:

→ Arrange all Data available in a Dataframe
→ Completing Data Cleansing process.
→ Comparing all mixes to calculate overal sore of each mix.

Finding Optimal Mixture in Every Cycle:

→ Arranging all computed Data in one DataFrame
→ Calculating individual score of each mix
→ Comparing every mix score in each stage and overall score
→ Finding optimal Mix at each Stage and best of all.

6. RESULTS AND DISCUSSION:

From the complete Descriptive Analysis, ~~to~~ finding out the optimal mixes and Analyzed Data which shows the Differentiations from each mixture at a every cycle.

28-Days Water Curing, 6 months Wet-Dry and Heat Cool Cycles:

From statistical Analyzed Data we get information regarding Mean and Standard Deviation of all mixtures along with performance in all specimens, we extract

Information of statistical Data.

Using Mean to compare with other mixes and used the result obtained to calculate overall score by adding all differences.

28-Days Water Curing:-

Mix ID	Optimal Mix	Score/Difference
M_0	M_7	8.6
M_1	M_7	9.3
M_2	M_7	9.8
M_3	M_7	10.9
M_4	M_7	20.6
M_5	M_7	27.4
M_6	M_7	1.3
M_7	M_7	0.0
M_8	M_7	5.2
M_9	M_7	26.0.

→ From the observation M7 outperform all other mixes in 28-days water Curing Stage.

6 months Wet-Dry Cycle

Mix ID	Optimal Mix	Score/Difference
M_0	M_6	24.9.
M_1	M_6	19.2
M_2	M_6	1.7
M_3	M_6	8.6.
M_4	M_6	5.7
M_5	M_6	12.8
M_6	M_6	0.0
M_7	M_6	10.3
M_8	M_6	11.5
M_9.	M_6	5.8

→ From the observation M6 outperforms all other mixes.

6-months Heat-cool Cycles

Mix ID	Optimal Mix	Score/Difference
M_0	M_2	0.8
M_1	M_2	0.1
M_2	M_2	0.0
M_3	M_2	23.3
M_4	M_2	5.1
M_5	M_2	13.1
M_6	M_2	4.9
M_7	M_2	8.6
M_8	M_2	4.8
M_9	M_2	2.4

→ From the Observations M_2 outperform all other mixes.

Optim/Best for all Cycles:-

→ From the overall scores of each mix at every stage, we calculate further analysis(sum) on individual scores.

Mix ID	28-Days	Wet-Dry	Heat-Cool	Sum
M_0	30.5	-110.7	61.4	-18.7
M_1	28.7	-71.8	68.7	22.6
M_2	21.2	89.0	68.2	178.5
M_3	12.1	15.7	-130.4	-102.5
M_4	-71.1	45.9	19.1	-6.0
M_5	-121.1	-19.4	-57.6	-198.2
M_6	109.4	105.3	17.2	232.0
M_7	121.7	-0.2	-15.3	106.2
M_8	66.9	-9.1	19.8	77.6
M_9	-110.5	44.3	39.6.	-26.6.
Optimal:-	M_7	M_6	M_2	$\boxed{M_6}$.

→ From the Observations, M6 is best suitable for all Cycles.

MPa .

MegaPascal is unit for Compressive Strength.

Remarks:-

- Optimal mix at 28 days, water-curing is Polypropelene Fiber with 0.2 volume fraction (M7)
- Optimal mix at 6 months, Heat-Cool Cycles is Steel Fiber with 0.6 volume fraction (M6)
- Optimal mix at 6 months, Wet-Dry Cycles is Date Palm Fiber with 1.0 volume fraction (M2)
- Optimal mix for all 3 cycles is Steel Fiber with 0.6 volume fraction (M6).

References:
github.com/s160785/Research/blob/main/Research_assignment.ipynb