International Journal of Advances in Engineering and Management (IJAEM)
Volume 4, Issue 8 Aug. 2022, pp: 1230-1236 www.ijaem.net ISSN: 2395-5252

# Prediction of Compressive Strength of Geopolymer Concrete using Decision trees

K Laxmi Narasimha[1], Hemanth[2], Dr. Pallavi Badry[3],
Dr.Kamalini Devi [4], Dr.Obulesh[5]

*Student, Department of Civil Engineering , VJIT, Hyderabad , Telangana.*
*Student Department of Artificial Engineering , VJIT Hyderabad Telangana.*
*Head Of The Department , Department of Civil engineering ,VJIT Hyderabad Telangana.*
*Associate Professor Department of Civil engineering VJIT Hyderabad Telangana.*
*Head of the Department , Department of Artificial Intelligence ,VJIT , Hyderabad , Telanagana.*

Submitted: 10-08-2022 Revised: 22-08-2022 Accepted: 24-08-2022

**ABSTRACT:-** Geopolymer is one of the booming concrete around the world. Cement is the third highest producer of green house gases in the atmosphere , but the amount of cement content used in the geopolymer concrete is null, hence it is a ecofriendly concrete. Decision tree is an algorithm in artificial intelligence , in which each limb node denotes a choice between number of substitutes, and each leaf node represent a decision. In this paper more than 200 data sets are used to train , validate and test the data in Decision tree to predict the compressive strength of geopolymer concrete..

**Key words:-** Decision Tree, Geopolymer concrete , leaf node

## I. INTRODUCTION:-

The geopolymer is used to describe the amorphous to crystalline reaction products from the synthesis of alkali aluminosillicates with alkali hydroxide/ alkali silicate solution. The polymerization reaction involves a rapid chemical reaction under alkali conditions on Si-Al mineral, resulting in a three dimensional polymeric chain and ring structure consisiting of Si-Al-O bonds . Decision tree alogorithm is inspired from the strcuctre of a tree , it contains root node, branch node and leaf node. Root node is father node of all nodes. In this alogorithm each node represent an attribute , each link represents a decision.

This alogorithm used to find the data in replacement stastiscal procedure, to extract text , medical certified fields and also in search engines( Harsh H patel et.al). Decision tree showed good accuracy in predicting the depth of carbonation (Woubishet zewdu taffese et.al). Decision tree reported a good performance in predicting the compressive strength of concrete with lesser root mean square error , mean absolute error, and higher correlation (saha dauji). Decision tree can be used to classify high strength concrete mix design based on the produced concrete mix proportions(saleh J.Alghamdi).Decision tree is a good predictor of seismic damage for reinforced concrete frame building concidering the micro structure(Liang su). In this paper 200 data set are collected from the previous literatures and Decision tree model was prepared , out of this 140 models for training , 30 data sets are used for validation and 30 data sets are used to test or predict the compressive strength of GPC.

## II. OBJECTIVES:-

- Collect the data of mix proportions from the literature review on geopolymer concrete.
- Prediction of the compressive strength is carried by Decision tree tool
- Analytical values are predicated from the decision tree tool validates by experimentation and comparison studies are carried out.

## III. EXPERIMENTAL INVESTIGATION

Prepare the Geopoloymer concrete based on the previous literature mix design. Cast the 150mm*150mm concrete cubes .There are two types curing is adopted for geopolymer concrete sun curing and oven curing . The preferred curing is oven curing since in oven curing the temperature is controlled unlike in sun curing. In this paper for the experimental work, oven curing is choosen. After 28 days curing , the concrete cube are taken out and tested in compressive strength machine and the compressive strength of concrete is found out.

**Fig.1 Mixing of Constituent materials**

### 3.1 STEP BY STEP PROCEDURE TO FIND OUT THE COMPRESSIVE STRENGTH OF GEOPOLYMER CONCRETE USING DECISION TREE

Step 1: Prepare data set;- Enter all the mix proportion values in excel spreadsheet
Step 2**.** Normalize the values.
Step 3: Configure the Decision tree'Training pattern' button in order to setup training data set. Immediately, you can see a new pop-up window. But it doesn't include any data initially.
Step 4**.** Copy the following region of the training data set in the Excel document.
Step 5. Click on the 'Paste all columns' button in the 'Decision Tree' - Training Pattern' window. It retrieves text data from clipboard and paste it to the table as shown in the figure
Step 6: Start learning process (=data regression)
Step 7: Predict new data set

## IV. RESULTS

**Table 1 :- Input and Output Parameters for predicting compressive strength**

| DATA INPUT | TYPE OF CONSTITUENTS |
|---|---|
| Input 1 | Amount of fly ash in kg/m$^3$ |
| Input 2 | Amount of GGBS in kg/m$^3$ |
| Input 3 | Amount of fine aggregate in kg/m$^3$ |
| Input 4 | Amount of coarse aggregate in kg/m$^3$ |
| Input 5 | Alkaline solution NaOH+Na2siO3 in kg/m$^3$ |
| Input 6 | Alkaline/binder ratio |
| Input 7 | Na2siO3/NaOH ratio |
| Input 8 | Molarity of the solution |
| Output | 28 days compressive strength of GPC (for oven curing) in N/mm$^2$ |

**Table 2:- TRAINING DATA SET:**

| s.no | Inp 1 | Inp 2 | Inp 3 | Inp 4 | Inp 5 | Inp 6 | Inp 7 | Inp 8 | output | Pred output |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 252 | 108 | 774 | 1091 | 162 | 0.45 | 2.5 | 8 | 40.78 | 41.8 |
| 2 | 252 | 108 | 774 | 1091 | 180 | 0.5 | 2.5 | 8 | 60.68 | 58.2 |
| 3 | 252 | 108 | 774 | 1091 | 198 | 0.55 | 2.5 | 8 | 64.6 | 60.3 |
| 4 | 252 | 111 | 774 | 1091 | 162 | 0.45 | 2.5 | 8 | 40.41 | 38.7 |
| 5 | 252 | 111 | 774 | 1091 | 180 | 0.5 | 2.5 | 8 | 61.3 | 61 |
| 6 | 252 | 111 | 774 | 1091 | 198 | 0.55 | 2.5 | 8 | 20 | 17.1 |
| 7 | 266 | 114 | 774 | 1091 | 162 | 0.45 | 2.5 | 8 | 42 | 41.4 |
| 8 | 266 | 114 | 774 | 1091 | 180 | 0.5 | 2.5 | 8 | 53.96 | 55.2 |
| 9 | 266 | 114 | 774 | 1091 | 198 | 0.55 | 2.5 | 8 | 28.01 | 28.2 |
| 10 | 273 | 117 | 774 | 1091 | 162 | 0.45 | 2.5 | 8 | 64.76 | 63.4 |
| 11 | 273 | 117 | 774 | 1091 | 180 | 0.5 | 2.5 | 8 | 57.27 | 57.9 |
| 12 | 273 | 117 | 774 | 1091 | 198 | 0.55 | 2.5 | 8 | 29.46 | 30.5 |
| 13 | 280 | 120 | 774 | 1091 | 162 | 0.45 | 2.5 | 8 | 59.03 | 58.4 |
| 14 | 280 | 120 | 774 | 1091 | 180 | 0.5 | 2.5 | 8 | 37 | 38.4 |

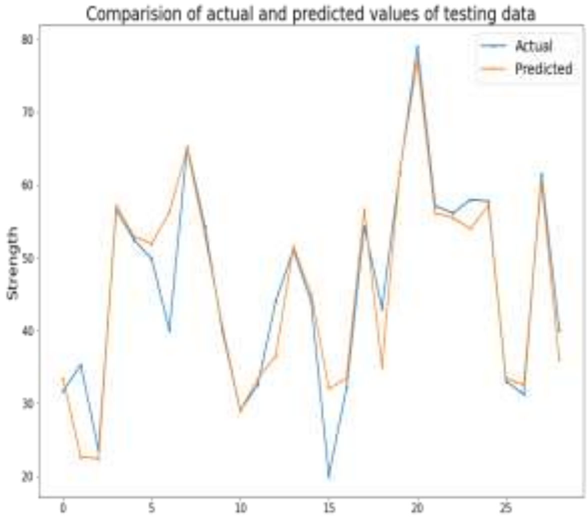
| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 15 | 280 | 120 | 774 | 1091 | 198 | 0.55 | 2.5 | 8 | 54 | 53.7 |
| 16 | 287 | 123 | 774 | 1091 | 162 | 0.45 | 2.5 | 8 | 44.18 | 42.9 |
| 17 | 287 | 123 | 774 | 1091 | 180 | 0.5 | 2.5 | 8 | 58.8 | 58 |
| 18 | 287 | 123 | 774 | 1091 | 198 | 0.55 | 2.5 | 8 | 43.35 | 44.7 |
| 19 | 294 | 126 | 810.6 | 966 | 189 | 0.45 | 2.5 | 8 | 59.73 | 60.4 |
| 20 | 294 | 126 | 810.6 | 966 | 210 | 0.5 | 2.5 | 8 | 55 | 54.6 |
| 21 | 294 | 126 | 810.6 | 966 | 231 | 0.55 | 2.5 | 8 | 30 | 31.4 |
| 22 | 301 | 129 | 810.6 | 966 | 189 | 0.45 | 2.5 | 8 | 29.6 | 28.9 |
| 23 | 301 | 129 | 810.6 | 966 | 210 | 0.5 | 2.5 | 8 | 82 | 80.2 |
| 24 | 301 | 129 | 810.6 | 966 | 231 | 0.55 | 2.5 | 8 | 42 | 39.1 |
| 25 | 308 | 132 | 810.6 | 966 | 189 | 0.45 | 2.5 | 8 | 76 | 73.4 |
| 26 | 308 | 132 | 810.6 | 966 | 210 | 0.5 | 2.5 | 8 | 60.47 | 61.2 |
| 27 | 308 | 132 | 810.6 | 966 | 231 | 0.55 | 2.5 | 8 | 56.66 | 53.89 |
| 28 | 315 | 135 | 760.5 | 972 | 202.5 | 0.45 | 2.5 | 8 | 42.88 | 46.7 |
| 29 | 315 | 135 | 760.5 | 972 | 225 | 0.5 | 2.5 | 8 | 33.8 | 35.9 |
| 30 | 315 | 135 | 760.5 | 972 | 247.5 | 0.55 | 2.5 | 8 | 36.39 | 38.5 |
| 31 | 216 | 144 | 774 | 1091 | 162 | 0.45 | 2.5 | 8 | 43 | 42 |
| 32 | 216 | 144 | 774 | 1091 | 180 | 0.5 | 2.5 | 8 | 33.49 | 34.2 |
| 33 | 216 | 144 | 774 | 1091 | 198 | 0.55 | 2.5 | 8 | 37 | 38.8 |
| 34 | 222 | 148 | 774 | 1091 | 162 | 0.45 | 2.5 | 8 | 38 | 40 |
| 35 | 222 | 148 | 774 | 1091 | 180 | 0.5 | 2.5 | 8 | 33 | 31.4 |
| 36 | 222 | 148 | 774 | 1091 | 198 | 0.55 | 2.5 | 8 | 58.98 | 60.7 |
| 37 | 228 | 152 | 774 | 1091 | 162 | 0.45 | 2.5 | 8 | 28.65 | 25.6 |
| 38 | 228 | 152 | 774 | 1091 | 180 | 0.5 | 2.5 | 8 | 77 | 76.5 |
| 39 | 228 | 152 | 774 | 1091 | 198 | 0.55 | 2.5 | 8 | 40.96 | 42.2 |
| 40 | 234 | 156 | 774 | 1091 | 162 | 0.45 | 2.5 | 8 | 29 | 30.48 |
| 41 | 234 | 156 | 774 | 1091 | 180 | 0.5 | 2.5 | 8 | 55.82 | 57.1 |
| 42 | 234 | 156 | 774 | 1091 | 198 | 0.55 | 2.5 | 8 | 22.6 | 25.7 |
| 43 | 240 | 160 | 774 | 1091 | 162 | 0.45 | 2.5 | 8 | 56.64 | 55.5 |
| 44 | 240 | 160 | 774 | 1091 | 180 | 0.5 | 2.5 | 8 | 57.37 | 55.5 |
| 45 | 240 | 160 | 774 | 1091 | 198 | 0.55 | 2.5 | 8 | 62.29 | 60.7 |
| 46 | 246 | 164 | 774 | 1091 | 162 | 0.45 | 2.5 | 8 | 77 | 77.9 |
| 47 | 246 | 164 | 774 | 1091 | 180 | 0.5 | 2.5 | 8 | 56.66 | 55.5 |
| 48 | 246 | 164 | 774 | 1091 | 198 | 0.55 | 2.5 | 8 | 57 | 56.7 |
| 49 | 252 | 168 | 810.6 | 966 | 189 | 0.45 | 2.5 | 8 | 56.4 | 55.8 |
| 50 | 252 | 168 | 810.6 | 966 | 210 | 0.5 | 2.5 | 8 | 45 | 38.9 |
| 51 | 252 | 168 | 810.6 | 966 | 231 | 0.55 | 2.5 | 8 | 41.15 | 42.6 |
| 52 | 258 | 172 | 810.6 | 966 | 189 | 0.45 | 2.5 | 8 | 35 | 39.6 |
| 53 | 258 | 172 | 810.6 | 966 | 210 | 0.5 | 2.5 | 8 | 36 | 38.8 |
| 54 | 258 | 172 | 810.6 | 966 | 231 | 0.55 | 2.5 | 8 | 36 | 39.2 |
| 55 | 264 | 176 | 810.6 | 966 | 189 | 0.45 | 2.5 | 8 | 59 | 58.6 |
| 56 | 264 | 176 | 810.6 | 966 | 210 | 0.5 | 2.5 | 8 | 33.94 | 33.3 |
| 57 | 264 | 176 | 810.6 | 966 | 231 | 0.55 | 2.5 | 8 | 56 | 52.4 |
| 58 | 270 | 180 | 810.6 | 966 | 189 | 0.45 | 2.5 | 8 | 25 | 23.4 |
| 59 | 270 | 180 | 810.6 | 966 | 210 | 0.5 | 2.5 | 8 | 38.63 | 37.3 |
| 60 | 270 | 180 | 810.6 | 966 | 231 | 0.55 | 2.5 | 8 | 72 | 73.8 |
| 61 | 180 | 180 | 774 | 1091 | 162 | 0.45 | 2.5 | 8 | 53.39 | 52.9 |
| 62 | 180 | 180 | 774 | 1091 | 180 | 0.5 | 2.5 | 8 | 57.2 | 56.3 |
| 63 | 185 | 185 | 774 | 1091 | 162 | 0.45 | 2.5 | 8 | 34.9 | 37 |
| 64 | 185 | 185 | 774 | 1091 | 180 | 0.5 | 2.5 | 8 | 83 | 83.9 |
| 65 | 190 | 190 | 774 | 1091 | 162 | 0.45 | 2.5 | 8 | 53.2 | 58.4 |
| 66 | 190 | 190 | 774 | 1091 | 180 | 0.5 | 2.5 | 8 | 54 | 54.1 |
| 67 | 195 | 195 | 774 | 1091 | 162 | 0.45 | 2.5 | 8 | 51.92 | 55.6 |

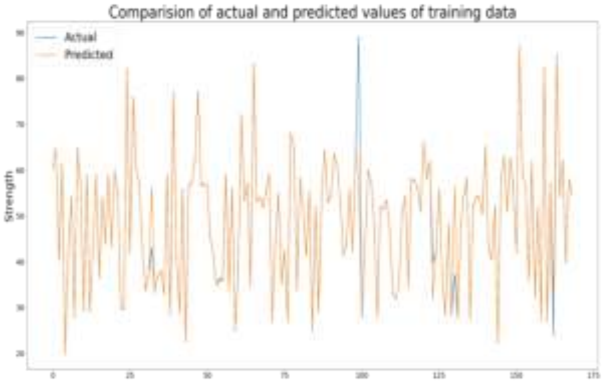
| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 68 | 195 | 195 | 774 | 1091 | 180 | 0.5 | 2.5 | 8 | 55.57 | 55.9 |
| 69 | 200 | 200 | 774 | 1091 | 162 | 0.45 | 2.5 | 8 | 59 | 59.8 |
| 70 | 200 | 200 | 774 | 1091 | 180 | 0.5 | 2.5 | 8 | 27.16 | 29.3 |
| 71 | 205 | 205 | 774 | 1091 | 162 | 0.45 | 2.5 | 8 | 44.18 | 40.5 |
| 72 | 205 | 205 | 774 | 1091 | 180 | 0.5 | 2.5 | 8 | 54.87 | 56.3 |
| 73 | 210 | 210 | 810.6 | 966 | 189 | 0.45 | 2.5 | 8 | 35.2 | 32.7 |
| 74 | 210 | 210 | 810.6 | 966 | 210 | 0.5 | 2.5 | 8 | 42.56 | 40.5 |
| 75 | 215 | 215 | 810.6 | 966 | 189 | 0.45 | 2.5 | 8 | 27 | 29.4 |
| 76 | 215 | 215 | 810.6 | 966 | 210 | 0.5 | 2.5 | 8 | 68 | 63.6 |
| 77 | 220 | 220 | 810.6 | 966 | 189 | 0.45 | 2.5 | 8 | 64.93 | 60.5 |
| 78 | 220 | 220 | 810.6 | 966 | 210 | 0.5 | 2.5 | 8 | 33.95 | 37.5 |
| 79 | 225 | 225 | 760.5 | 972 | 202.5 | 0.45 | 2.5 | 8 | 58.24 | 60.1 |
| 80 | 225 | 225 | 760.5 | 972 | 225 | 0.5 | 2.5 | 8 | 52.13 | 57 |
| 81 | 252 | 108 | 774 | 1091 | 216 | 0.6 | 2.5 | 8 | 41.53 | 44.2 |
| 82 | 259 | 111 | 774 | 1091 | 216 | 0.6 | 2.5 | 8 | 55.6 | 54.3 |
| 83 | 266 | 114 | 774 | 1091 | 216 | 0.6 | 2.5 | 8 | 25 | 28.7 |
| 84 | 273 | 117 | 774 | 1091 | 216 | 0.6 | 2.5 | 8 | 52 | 51.8 |
| 85 | 280 | 120 | 774 | 1091 | 216 | 0.6 | 2.5 | 8 | 30 | 35.5 |
| 86 | 287 | 123 | 774 | 1091 | 216 | 0.6 | 2.5 | 8 | 55 | 48.7 |
| 87 | 294 | 126 | 810.6 | 966 | 189 | 0.6 | 2.5 | 8 | 64.28 | 61.95 |
| 88 | 301 | 129 | 810.6 | 966 | 189 | 0.6 | 2.5 | 8 | 53.05 | 56.1 |
| 89 | 308 | 132 | 810.6 | 966 | 189 | 0.6 | 2.5 | 8 | 54.4 | 49.75 |
| 90 | 315 | 135 | 760.5 | 972 | 270 | 0.6 | 2.5 | 8 | 63.47 | 68.2 |
| 91 | 216 | 144 | 774 | 1091 | 162 | 0.6 | 2.5 | 8 | 61.22 | 60.8 |
| 92 | 222 | 148 | 774 | 1091 | 162 | 0.6 | 2.5 | 8 | 52.93 | 54.9 |
| 93 | 228 | 152 | 774 | 1091 | 162 | 0.6 | 2.5 | 8 | 41.53 | 43.3 |
| 94 | 234 | 156 | 774 | 1091 | 162 | 0.6 | 2.5 | 8 | 43.84 | 40.8 |
| 95 | 240 | 160 | 774 | 1091 | 162 | 0.6 | 2.5 | 8 | 55.78 | 55.4 |
| 96 | 246 | 164 | 774 | 1091 | 162 | 0.6 | 2.5 | 8 | 42.56 | 40.2 |
| 97 | 252 | 168 | 810.6 | 966 | 252 | 0.6 | 2.5 | 8 | 64.43 | 59.5 |
| 98 | 258 | 172 | 810.6 | 966 | 252 | 0.6 | 2.5 | 8 | 89 | 87.9 |
| 99 | 264 | 176 | 810.6 | 966 | 252 | 0.6 | 2.5 | 8 | 28 | 35.5 |
| 100 | 270 | 180 | 760.5 | 972 | 270 | 0.6 | 2.5 | 8 | 43.19 | 39.4 |
| 101 | 180 | 180 | 774 | 1091 | 198 | 0.55 | 2.5 | 8 | 59.86 | 57.1 |
| 102 | 185 | 185 | 774 | 1091 | 198 | 0.55 | 2.5 | 8 | 57.37 | 56.3 |
| 103 | 190 | 190 | 774 | 1091 | 198 | 0.55 | 2.5 | 8 | 48 | 45.7 |
| 104 | 195 | 195 | 774 | 1091 | 198 | 0.55 | 2.5 | 8 | 28 | 30.4 |
| 105 | 200 | 200 | 774 | 1091 | 198 | 0.55 | 2.5 | 8 | 52 | 48.9 |
| 106 | 205 | 205 | 774 | 1091 | 198 | 0.55 | 2.5 | 8 | 51.54 | 55.6 |
| 107 | 210 | 210 | 810.6 | 966 | 210 | 0.55 | 2.5 | 8 | 53.39 | 54.6 |
| 108 | 215 | 215 | 810.6 | 966 | 210 | 0.55 | 2.5 | 8 | 47 | 42.2 |
| 109 | 220 | 220 | 810.6 | 966 | 210 | 0.55 | 2.5 | 8 | 33 | 34.6 |
| 110 | 225 | 225 | 760.5 | 972 | 247.5 | 0.55 | 2.5 | 8 | 32 | 35 |
| 111 | 898 | 0 | 898 | 610 | 405.24 | 0.45 | 2.5 | 8 | 35 | 31.8 |
| 112 | 808 | 89.9 | 898 | 610 | 405.24 | 0.45 | 2.5 | 8 | 51 | 48.7 |
| 113 | 718 | 179.6 | 898 | 610 | 405.24 | 0.45 | 2.5 | 8 | 54.2 | 59.2 |
| 114 | 629 | 269.4 | 898 | 610 | 405.24 | 0.45 | 2.5 | 8 | 34.6 | 44.1 |
| 115 | 539 | 359.2 | 898 | 610 | 405.24 | 0.45 | 2.5 | 8 | 58.03 | 58 |
| 116 | 898 | 0 | 898 | 610 | 405.24 | 0.45 | 2.5 | 12 | 57.84 | 55.6 |
| 117 | 808 | 89.8 | 898 | 610 | 405.24 | 0.45 | 2.5 | 12 | 56 | 56.9 |
| 118 | 718 | 179.6 | 898 | 610 | 405.24 | 0.45 | 2.5 | 12 | 51 | 48.9 |
| 119 | 629 | 269.4 | 898 | 610 | 405.24 | 0.45 | 2.5 | 12 | 66 | 62.5 |
| 120 | 539 | 359.2 | 898 | 610 | 405.24 | 0.45 | 2.5 | 12 | 58.29 | 68 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 121 | 898 | 0 | 898 | 610 | 405.24 | 0.45 | 2.5 | 16 | 61.9 | 67 |
| 122 | 808 | 89.8 | 898 | 610 | 405.24 | 0.45 | 2.5 | 16 | 40 | 42.5 |
| 123 | 718 | 179.6 | 898 | 610 | 405.24 | 0.45 | 2.5 | 16 | 42.1 | 43.78 |
| 124 | 180 | 718.4 | 898.3 | 610 | 405.24 | 0.45 | 2.5 | 8 | 55.78 | 59.75 |
| 125 | 89.8 | 808.2 | 898.3 | 610 | 405.24 | 0.45 | 2.5 | 8 | 37.3 | 42.95 |
| 126 | 0 | 898 | 898.3 | 610 | 405.24 | 0.45 | 2.5 | 8 | 28.58 | 28 |
| 127 | 180 | 718.4 | 898.3 | 610 | 405.24 | 0.45 | 2.5 | 12 | 48 | 46.5 |
| 128 | 89.8 | 808.2 | 898.3 | 610 | 405.24 | 0.45 | 2.5 | 12 | 28.3 | 29.56 |
| 129 | 0 | 898 | 898.3 | 610 | 405.24 | 0.45 | 2.5 | 12 | 37 | 38 |
| 130 | 180 | 718.4 | 898.3 | 610 | 405.24 | 0.45 | 2.5 | 16 | 27.73 | 32.54 |
| 131 | 89.8 | 808.2 | 898.3 | 610 | 405.24 | 0.45 | 2.5 | 16 | 48 | 49.58 |
| 132 | 408 | 0 | 530.4 | 1265 | 144 | 0.35 | 2.51 | 10 | 55 | 56.7 |
| 133 | 408 | 0 | 571.2 | 1306 | 144 | 0.35 | 2.51 | 10 | 58.2 | 60.8 |
| 134 | 408 | 0 | 612 | 1346 | 144 | 0.35 | 2.51 | 10 | 27.77 | 35.98 |
| 135 | 408 | 0 | 652.8 | 1387 | 144 | 0.35 | 2.51 | 10 | 52.0 | 56.98 |
| 136 | 400 | 0 | 850 | 950 | 200 | 0.49 | 2.5 | 12 | 54.32 | 58.75 |
| 137 | 400 | 0 | 850 | 950 | 200 | 0.5 | 2.5 | 12 | 54.01 | 55.6 |
| 138 | 400 | 0 | 658 | 1222 | 140 | 0.35 | 2.5 | 14 | 50.64 | 53.48 |
| 139 | 400 | 0 | 658 | 1222 | 140 | 0.35 | 1.5 | 14 | 65.69 | 69.75 |
| 140 | 404 | 280.3 | 820.2 | 838 | 308.53 | 0.475 | 2.466 | 10.966 | 43.03 | 49.32 |
| 141 | 408 | 0 | 554 | 1294 | 154.5 | 0.37 | 2 | 14 | 40.59 | 48.9 |
| 142 | 408 | 0 | 647 | 1201 | 144 | 0.35 | 2.51 | 14 | 51.98 | 59.5 |
| 143 | 408 | 0 | 647 | 1201 | 144 | 0.35 | 2.51 | 16 | 22.4 | 27.9 |
| 144 | 408 | 0 | 554 | 1294 | 144 | 0.35 | 2.51 | 14 | 58.06 | 51.36 |
| 145 | 408 | 0 | 647 | 1201 | 144 | 0.35 | 2.51 | 12 | 63 | 59.36 |
| 146 | 408 | 0 | 647 | 1201 | 144 | 0.35 | 2.51 | 14 | 51.22 | 57.26 |
| 147 | 408 | 0 | 647 | 1201 | 144 | 0.35 | 2.51 | 10 | 62.656 | 68.25 |
| 148 | 408 | 0 | 647 | 1201 | 144 | 0.35 | 2.51 | 8 | 56.19 | 59.15 |
| 149 | 408 | 0 | 554 | 1294 | 168 | 0.41 | 1.4 | 8 | 42 | 43.5 |
| 150 | 476 | 0 | 554 | 1294 | 144 | 0.3 | 2.51 | 8 | 87 | 78.9 |
| 151 | 476 | 0 | 554 | 1294 | 168 | 0.3 | 2.51 | 14 | 59 | 69.2 |
| 152 | 408 | 0 | 647 | 1201 | 144 | 0.35 | 2.51 | 14 | 56.304 | 58.1 |
| 153 | 408 | 0 | 554 | 1246 | 144 | 0.35 | 2.51 | 8 | 36 | 37.4 |
| 154 | 408 | 0 | 554 | 1080 | 144 | 0.35 | 2.51 | 8 | 61.95 | 63.98 |
| 155 | 408 | 0 | 554 | 1243 | 144 | 0.35 | 2.51 | 8 | 35.59 | 36.7 |
| 156 | 408 | 0 | 616 | 1232 | 151 | 0.37 | 2.14 | 14 | 52 | 49.5 |
| 157 | 408 | 0 | 616 | 1232 | 158.4 | 0.37 | 1.85 | 8 | 27.44 | 28.69 |
| 158 | 408 | 0 | 616 | 1232 | 144 | 0.35 | 2.51 | 14 | 82.5 | 71.25 |
| 159 | 408 | 0 | 616 | 1232 | 144 | 0.35 | 2.51 | 16 | 27.16 | 36.25 |
| 160 | 408 | 0 | 616 | 1232 | 144 | 0.35 | 2.51 | 12 | 57 | 58.35 |
| 161 | 408 | 0 | 616 | 1232 | 144 | 0.35 | 2.51 | 10 | 24 | 31.3 |
| 162 | 408 | 0 | 616 | 1232 | 144 | 0.35 | 2.51 | 8 | 85 | 79.5 |
| 163 | 421 | 0 | 555.7 | 1032 | 117.7 | 0.27 | 2.13 | 10 | 54.38 | 56.2 |
| 164 | 350 | 0 | 645 | 1200 | 144 | 0.41 | 2.51 | 8 | 61.96 | 63.2 |
| 165 | 365 | 0 | 602 | 1118 | 107.3 | 0.29 | 2.12 | 10 | 39.91 | 40.2 |
| 166 | 255 | 0 | 694.7 | 1290 | 71.3 | 0.28 | 2.12 | 10 | 58 | 59.2 |
| 167 | 310 | 0 | 648.4 | 1204 | 86.7 | 0.27 | 2.12 | 10 | 54.97 | 53.63 |
| 168 | 400 | 0 | 540 | 1233 | 148 | 0.37 | 2.49 | 16 | 45.97 | 45.6 |
| 169 | 408 | 0 | 647 | 1201 | 155 | 0.37 | 1.5 | 14 | 38.6 | 37.9 |
| 170 | 408 | 0 | 647 | 1201 | 171 | 0.41 | 1.51 | 14 | 59 | 63 |

**Table 3:- Prediction Data set**

| s.no | Inp 1 | Inp 2 | Inp 3 | Inp 4 | Inp 5 | Inp 6 | Inp 7 | Inp 8 | output | Pred output |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 368 | 0 | 554 | 1294 | 184 | 0.5 | 2.47 | 8 | 54.4 | 53.9 |
| 2 | 533 | 0 | 1601 | 0 | 143.5 | 0.26 | 2.5 | 8 | 56.4 | 55.4 |
| 3 | 378 | 0 | 554 | 1294 | 174 | 0.46 | 2.48 | 12 | 34.6 | 36.4 |
| 4 | 408 | 0 | 647 | 1201 | 201 | 0.49 | 2.19 | 12 | 54.2 | 59.2 |
| 5 | 404 | 0 | 640 | 1190 | 143 | 0.35 | 2.48 | 14 | 37 | 36.8 |
| 6 | 404 | 0 | 640 | 1190 | 143 | 0.35 | 2.48 | 14 | 36 | 34.5 |
| 7 | 404 | 0 | 640 | 1190 | 203 | 0.5 | 2.48 | 14 | 76 | 78.6 |
| 8 | 408 | 0 | 647 | 1202 | 144 | 0.35 | 2.51 | 16 | 42 | 46.5 |
| 9 | 404 | 0 | 640 | 1190 | 443 | 0.98 | 2.5 | 14 | 66 | 68.6 |
| 10 | 428 | 0 | 630 | 1170 | 171 | 0.39 | 2 | 14 | 20 | 26.8 |
| 11 | 428 | 0 | 630 | 1170 | 171 | 0.39 | 2 | 14 | 24 | 29.7 |
| 12 | 428 | 0 | 630 | 1170 | 171 | 0.39 | 2.48 | 14 | 28 | 30.7 |
| 13 | 428 | 0 | 630 | 1170 | 171 | 0.39 | 2.48 | 14 | 29 | 29.7 |
| 14 | 444 | 0 | 630 | 1170 | 155 | 0.36 | 2.52 | 14 | 30 | 35.7 |
| 15 | 428 | 0 | 630 | 1170 | 171 | 0.39 | 2.48 | 14 | 30 | 32.8 |
| 16 | 428 | 0 | 630 | 1170 | 171 | 0.39 | 2 | 8 | 32 | 35.7 |
| 17 | 428 | 0 | 630 | 1170 | 171 | 0.39 | 2 | 10 | 35 | 39.5 |
| 18 | 428 | 0 | 630 | 1170 | 171 | 0.39 | 2 | 14 | 40 | 35.6 |
| 19 | 428 | 0 | 630 | 1170 | 171 | 0.39 | 2 | 12 | 43 | 41.58 |
| 20 | 408 | 0 | 554 | 1294 | 144 | 0.35 | 2.51 | 14 | 36 | 36.8 |
| 21 | 408 | 0 | 554 | 1294 | 144 | 0.35 | 2.51 | 8 | 56 | 59.6 |
| 22 | 494 | 0 | 691 | 858 | 198 | 0.5 | 1 | 14 | 42.1 | 43.7 |
| 23 | 416 | 0 | 699 | 927 | 357 | 0.8 | 4.49 | 15 | 82.5 | 78.9 |
| 24 | 416 | 0 | 699 | 927 | 357 | 0.85 | 4.49 | 15 | 36.9 | 41.8 |
| 25 | 420 | 0 | 706 | 936 | 333 | 0.79 | 2.61 | 15 | 34.9 | 39.5 |
| 26 | 412 | 0 | 693 | 918 | 381 | 0.72 | 2.61 | 15 | 29.6 | 34.2 |
| 27 | 409 | 0 | 686 | 909 | 333 | 0.81 | 1.58 | 15 | 22.4 | 28.5 |
| 28 | 409 | 0 | 699 | 920 | 381 | 0.81 | 1.57 | 15 | 23.5 | 26.7 |
| 29 | 210 | 210 | 765 | 1005 | 380 | 0.5 | 2.5 | 20 | 56.304 | 59.6 |
| 30 | 240 | 160 | 770 | 1010 | 357 | 0.5 | 2.5 | 20 | 52.201 | 57.88 |





## V. CONCLUSIONS

Based on the objectives of the study the following conclusions are drawn:

1. Decision tree model is a reliable computational model to solve different complex problems such as prediction problems.
2. Present study is the application of Decision tree model to predict the 28 days compressive strength of geopolymer concrete based on different concrete characteristics.
3. Decision tree analysis indicates good correlation between the input and output variable.
4. The statistical parameter $R^2$ is 0.947, and 0.857 for training and testing steps, respectively, which implies good efficiency of the Decision tree model.
5. It is concluded that Decision tree presents good accuracy in predicting the 28 days compressive strength of geoploymer concrete.
6. Therefore, in order to predict the compressive strength of concrete with high reliability, instead of using costly experimental investigation, Decision tress model can be replaced.

**Scope of the project**

Further studies should carried out on various properties like flexural and shear behaviour of GPC

## REFERENCES

[1]. J. Davidovits, "Synthetic mineral polymer compound of the silicoaluminate family and preparation process", US patent 4472199, (1978).

[2]. E. Schmit, "Experiment with the new concrete test hammer for determining the quality of concrete," schweizer Archive fur angewandte wissenschoft und technik, vol. 17, no 5, pp. 139-43, 1951.

[3]. E. Schmit, "Experiment with the new concrete test hammer for determining the quality of concrete," schweizer Archive fur angewandte wissenschoft und technik, vol. 17, no 5, pp. 139-43, 1951.

[4]. G. Mallikarjuna Rao, T. D. Gunneswara Rao, Rama Seshu D., A. Venkatesh Department of Civil Engineering, National Institute of Technology, Warangal, India Składy mieszanekzbetonu geopolimerowego Mix proportioning of geopolymer concrete.

[5]. Guang NH, Zong WJ (2000). Prediction of compressive strength of concrete by neural networks. J. Cem. Concrete Res., 30: 1245-1250.

[6]. Woubishet zewdu tafese ,"Prediction of concrete carbonation depth using Decision trees.ISBN978-287587014-8.

[7]. Harsh H.patel, "study and analysis of Decision tree based classification alogorithm ", E-ISSN:2347-2693.

[8]. C Deepa,"Prediction of the compressive strength of High Performance concrete mix using Tree based modeling',Internationl journal of computer application(0975-8887)

[9]. Saha Dauji,"Prediction of compressive strength of concrete with decision trees",International Journal vol-2,no1.

[10]. Liang su, " Decision tree-based seismic damage prediction for reinforcement concrete frame building considering structural micro characteristics" doi.org/10.1177/1369433219832508.

[11]. Zhifei zhang "Decision tree alogorithm based moel and computer simulation for evaluating the effectiveness of physical education ,doi.org/10.1155/2020/8868793.