

Article

Explainable Predictive Modelling of Sustainable Slag–Fly Ash Based Geopolymer Concrete with Life Cycle and Carbon-Neutrality Assessment

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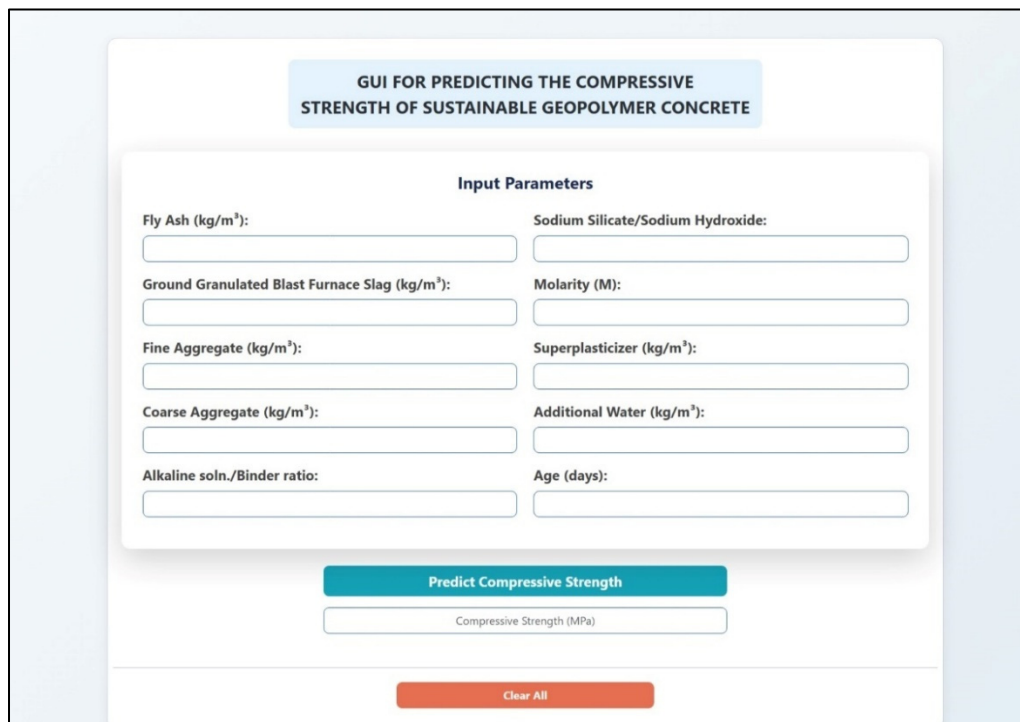
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S1. Prototype Graphical User Interface (GUI)

A prototype GUI (as shown in Figure S1) was developed to demonstrate the practical deployment potential of the trained ML model for predicting the f_c of SFGPC. The GUI is provided solely as a supplementary, practitioner-oriented tool and is not intended to represent a finalized software product or a core research outcome of the present study.

The interface allows users to input key mix-design parameters, including binder composition, aggregate content, alkaline-to-binder ratio, and curing age. Based on these inputs, the trained GB model generates a predicted f_c value. The GUI is intended to illustrate how the explainable predictive framework proposed in this study can be translated into a user-accessible format for engineering applications.

This supplementary GUI serves as a proof-of-concept demonstration. Further development, validation, and deployment as a standalone application remain beyond the scope of the current work.



The screenshot shows a web-based GUI titled "GUI FOR PREDICTING THE COMPRESSIVE STRENGTH OF SUSTAINABLE GEOPOLYMER CONCRETE". It features a central form with two columns of input fields. The left column includes: Fly Ash (kg/m³), Ground Granulated Blast Furnace Slag (kg/m³), Fine Aggregate (kg/m³), Coarse Aggregate (kg/m³), and Alkaline soln./Binder ratio. The right column includes: Sodium Silicate/Sodium Hydroxide, Molarity (M), Superplasticizer (kg/m³), Additional Water (kg/m³), and Age (days). Below the input fields is a blue button labeled "Predict Compressive Strength". Underneath this button is a text box for the output, labeled "Compressive Strength (MPa)". At the bottom of the form is a red button labeled "Clear All".

Figure S1. Prototype GUI interface for predicting the f_c of sustainable SFGPC.

S2. Trained Model Parameters and Configurations for Reproducibility

This section provides the complete set of optimized hyperparameters and model configurations required to reproduce the ML models developed in this study. Since different ML model families represent “weights” differently, model-specific configurations are reported following standard practices in computational intelligence research.

S2.1. ANN Model

Unlike tree-based models, ANN contain explicit numerical weights and bias terms.

S2.1.1. ANN Architecture

Table S1. ANN architecture details.

Component	Description
Input layer	Number of neurons equal to number of input features
Hidden layers	2
Neurons per hidden layer	12, 12
Activation function	ReLU
Output layer	Single neuron (f_c)
Optimizer	Adam

S2.1.2. ANN Training Parameters

Table S2. ANN training hyperparameters.

Parameter	Value
L2 regularization (α)	0.0005
Maximum iterations	1,000,000
Learning rate	Adaptive (Adam default)
Batch size	Default
Early stopping	Disabled

The trained ANN weight matrices and bias vectors can be directly extracted from the trained model to enable exact reconstruction.

S2.2. DT Model

Table S3. Optimized DT hyperparameters.

Hyperparameter	Value
Maximum tree depth	125
Minimum samples per leaf	2
Minimum samples split	3
Splitting criterion	Mean squared error
Random state	Default

S2.3. RF Model

RF predictions are obtained by aggregating multiple decorrelated DTs. The model behaviour is governed by ensemble configuration rather than explicit scalar weights.

Table S4. Optimized RF hyperparameters.

Hyperparameter	Value
Number of trees	50
Maximum tree depth	8
Minimum samples split	2
Bootstrap sampling	Enabled
Random state	Default

S2.4. AdB Model

AdB assigns implicit weights to weak learners during training, which are embedded within the trained ensemble.

Table S5. Optimized AdB hyperparameters.

Hyperparameter	Value
Base estimator	Decision tree
Number of estimators	5
Learning rate	0.6
Loss function	Exponential
Random state	40

S2.5 GB Model

GB models are fully defined by their optimized hyperparameters and the ensemble of DTs learned during training.

Table S6. Optimized GB hyperparameters.

Hyperparameter	Value
Number of estimators	100
Learning rate	0.100
Maximum tree depth	5
Minimum samples split	3
Loss function	Squared error
Random state	Default

All models were trained using standardized input features obtained through z-score normalization. Hyperparameters were selected using a systematic grid-search combined with cross-validation. The configurations reported in this Supplementary Material enable independent researchers to reproduce and further investigate the predictive models developed in this study.

Dataset S1.

FIA kg/m ³	GGBFS kg/m ³	Fagg. kg/m ³	Cagg. kg/m ³	Alk./B -	SS/SH -	M Molar	Sp kg/m ³	W kg/m ³	A Days	f_c MPa
500	0	707	1060	0.3	1.5	14	0	74	7	28.4
500	0	707	1060	0.3	1.5	14	0	74	14	30.4
500	0	707	1060	0.3	1.5	14	0	74	28	32.8
450	50	707	1060	0.3	1.5	14	0	74	7	44.1
450	50	707	1060	0.3	1.5	14	0	74	14	48.6
450	50	707	1060	0.3	1.5	14	0	74	28	48.9
400	100	707	1060	0.3	1.5	14	0	74	7	47.7
400	100	707	1060	0.3	1.5	14	0	74	14	52.9
400	100	707	1060	0.3	1.5	14	0	74	28	53.2
500	0	623	1016	0.35	1.5	14	0	0	3	6.682
500	0	623	1016	0.35	1.5	14	0	0	7	11.492
500	0	623	1016	0.35	1.5	14	0	0	28	21.915
450	50	647	1056	0.315	1.5	14	0	0	3	14.788
450	50	647	1056	0.315	1.5	14	0	0	7	22.45
450	50	647	1056	0.315	1.5	14	0	0	28	32.428
400	100	671	1095	0.28	1.5	14	0	0	3	17.906
400	100	671	1095	0.28	1.5	14	0	0	7	21.737
400	100	671	1095	0.28	1.5	14	0	0	28	30.824
350	150	696	1135	0.245	1.5	14	0	0	3	17.728
350	150	696	1135	0.245	1.5	14	0	0	7	25.924
350	150	696	1135	0.245	1.5	14	0	0	28	38.575
120	160	432.2	1331.66	0.714286	1.5	16	4	0	7	22.357
119.88	159.84	432.2	1331.66	0.715001	1.5	16	4	0	7	22.787
119.76	159.68	432.2	1331.66	0.715717	1.5	16	4	0	7	23.503
119.64	159.52	432.2	1331.66	0.716435	1.5	16	4	0	7	22.357
119.52	159.36	432.2	1331.66	0.627195	1.5	16	4	0	7	21.783
119.4	159.2	432.2	1331.66	0.717051	1.5	16	4	0	7	20.064

119.28	159.04	432.2	1331.66	0.718597	1.5	16	4	0	7	20.064
120	160	432.2	1331.66	0.718597	1.5	16	4	0	28	36.831
119.88	159.84	432.2	1331.66	0.718597	1.5	16	4	0	28	39.268
119.76	159.68	432.2	1331.66	0.718597	1.5	16	4	0	28	39.268
119.64	159.52	432.2	1331.66	0.718597	1.5	16	4	0	28	38.264
119.52	159.36	432.2	1331.66	0.718597	1.5	16	4	0	28	36.831
119.4	159.2	432.2	1331.66	0.718597	1.5	16	4	0	28	32.818
119.28	159.04	432.2	1331.66	0.718597	1.5	16	4	0	28	30.525
365.4	40.6	609	1218	0.4	2.5	8	0	14	28	39.096
324.8	81.2	609	1218	0.4	2.5	8	0	22	28	45.319
284.2	121.8	609	1218	0.4	2.5	8	0	34	28	52.34
324.8	81.2	609	1218	0.45	2.5	8	0	11	28	37.66
284.2	121.8	609	1218	0.45	2.5	8	0	18	28	43.245
365.4	40.6	609	1218	0.4	2.5	8	0	14	60	40.851
324.8	81.2	609	1218	0.4	2.5	8	0	22	60	45.319
284.2	121.8	609	1218	0.4	2.5	8	0	34	60	54.415
324.8	81.2	609	1218	0.45	2.5	8	0	11	60	37.979
284.2	121.8	609	1218	0.45	2.5	8	0	18	60	43.723
225	303	555	991	0.549242	2.493976	10	10.55	0	7	12.05
195	263	601	1073	0.550218	2.5	10	9.16	0	7	21.491
165	222	647	1157	0.550388	2.491803	10	7.76	0	7	18.012
225	303	555	991	0.549242	2.493976	10	10.55	0	14	19.752
195	263	601	1073	0.550218	2.5	10	9.16	0	14	31.553
165	222	647	1157	0.550388	2.491803	10	7.76	0	14	26.087
225	303	555	991	0.549242	2.493976	10	10.55	0	28	24.348
195	263	601	1073	0.550218	2.5	10	9.16	0	28	35.528
165	222	647	1157	0.550388	2.491803	10	7.76	0	28	30.062
195	263	515	1156	0.550218	2.5	10	9.16	0	7	11.676
195	263	601	1073	0.550218	2.5	10	9.16	0	7	21.189
195	263	687	991	0.550218	2.5	10	9.16	0	7	18.162
195	263	515	1156	0.550218	2.5	10	9.16	0	14	19.243
195	263	601	1073	0.550218	2.5	10	9.16	0	14	31.892
195	263	687	991	0.550218	2.5	10	9.16	0	14	25.514
195	263	515	1156	0.550218	2.5	10	9.16	0	28	24
195	263	601	1073	0.550218	2.5	10	9.16	0	28	34.703
195	263	687	991	0.550218	2.5	10	9.16	0	28	29.622
195	263	601	1073	0.550218	2	10	8.41	0	7	28.765
195	263	601	1073	0.550218	2.5	10	8.78	0	7	25.679
195	263	601	1073	0.550218	3	10	9.16	0	7	21.605
195	263	601	1073	0.550218	3.5	10	9.45	0	7	20.494
195	263	601	1073	0.550218	2	10	8.41	0	14	35.062
195	263	601	1073	0.550218	2.5	10	8.78	0	14	32.593
195	263	601	1073	0.550218	3	10	9.16	0	14	26.049
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195	263	601	1073	0.550218	2	10	8.41	0	28	37.407
195	263	601	1073	0.550218	2.5	10	8.78	0	28	35.185
195	263	601	1073	0.550218	3	10	9.16	0	28	28.272
195	263	601	1073	0.550218	3.5	10	9.45	0	28	25.556
421	0	601	1073	0.548694	2	10	8.41	0	7	0.407
303	136	601	1073	0.546697	2	10	8.78	0	7	13.686
195	263	601	1073	0.550218	2	10	9.16	0	7	26.069
94	379	601	1073	0.488372	1.655172	10	9.45	0	7	21.507
0	487	601	1073	0.548255	2	10	9.16	0	7	20.285
421	0	601	1073	0.548694	2	10	8.41	0	14	0.733
303	136	601	1073	0.546697	2	10	8.78	0	14	17.352
195	263	601	1073	0.550218	2	10	9.16	0	14	31.935
94	379	601	1073	0.488372	1.655172	10	9.45	0	14	25.743
0	487	601	1073	0.548255	2	10	9.16	0	14	24.033
421	0	601	1073	0.548694	2	10	8.41	0	28	0.733
303	136	601	1073	0.546697	2	10	8.78	0	28	20.285
195	263	601	1073	0.550218	2	10	9.16	0	28	33.89
94	379	601	1073	0.488372	1.655172	10	9.45	0	28	29.98
0	487	601	1073	0.548255	2	10	9.16	0	28	26.069

303	136	601	1073	0.551253	2.507246	10	8.81	0	7	11.636
195	263	601	1073	0.550218	2.5	10	9.16	0	7	22.869
94	379	601	1073	0.549683	2.513514	10	9.49	0	7	20.768
0	488	601	1073	0.473361	2	10	9.79	0	7	19.475
303	136	601	1073	0.551253	2.507246	10	8.81	0	14	14.384
195	263	601	1073	0.550218	2.5	10	9.16	0	14	29.576
94	379	601	1073	0.549683	2.513514	10	9.49	0	14	24.727
0	488	601	1073	0.473361	2	10	9.79	0	14	22.303
303	136	601	1073	0.551253	2.507246	10	8.81	0	28	16.889
195	263	601	1073	0.550218	2.5	10	9.16	0	28	32
94	379	601	1073	0.549683	2.513514	10	9.49	0	28	27.96
0	488	601	1073	0.473361	2	10	9.79	0	28	27.313
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195	263	601	1073	0.550218	2.5	10	9.16	0	14	36.55
195	263	601	1073	0.550218	2.5	10	9.16	0	28	23.392
195	263	601	1073	0.550218	2.5	10	9.16	0	28	29.825
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195	263	601	1073	0.550218	2.5	10	9.16	0	28	35.38
195	263	601	1073	0.550218	2.5	10	9.16	0	28	37.817
366.1	40.68	610.2	1220.35	0.399971	2.50043	8	0	0	3	15.46
366.1	40.68	610.2	1220.35	0.399971	2.50043	8	0	0	3	22.57
366.1	40.68	610.2	1220.35	0.399971	2.50043	8	0	0	3	25.4
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325.42	81.36	610.2	1220.35	0.399971	2.50043	8	0	0	3	18.25
325.42	81.36	610.2	1220.35	0.399971	2.50043	8	0	0	3	25.79
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284.74	122.03	610.2	1220.35	0.39998	2.50043	8	0	0	3	31.15
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0	400	635	1210	0.43	2.510204	12	16	20	3	34.406
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40	360	635	1210	0.43	2.510204	12	16	20	3	31.662
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40	360	635	1210	0.43	2.510204	12	16	20	28	45.805
40	360	635	1210	0.43	2.510204	12	16	20	60	49.604
40	360	635	1210	0.43	2.510204	12	16	20	120	63.958
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80	320	635	1210	0.43	2.510204	12	16	20	28	44.327
80	320	635	1210	0.43	2.510204	12	16	20	60	47.071
80	320	635	1210	0.43	2.510204	12	16	20	120	61.636
80	320	635	1210	0.43	2.510204	12	16	20	180	64.38
120	280	635	1210	0.43	2.510204	12	16	20	3	28.496
120	280	635	1210	0.43	2.510204	12	16	20	7	35.884
120	280	635	1210	0.43	2.510204	12	16	20	28	44.116
120	280	635	1210	0.43	2.510204	12	16	20	60	45.172
120	280	635	1210	0.43	2.510204	12	16	20	120	61.847
120	280	635	1210	0.43	2.510204	12	16	20	180	62.902
160	240	635	1210	0.43	2.510204	12	16	20	3	25.33
160	240	635	1210	0.43	2.510204	12	16	20	7	30.818
160	240	635	1210	0.43	2.510204	12	16	20	28	44.116
160	240	635	1210	0.43	2.510204	12	16	20	60	43.272
160	240	635	1210	0.43	2.510204	12	16	20	120	49.393
160	240	635	1210	0.43	2.510204	12	16	20	180	52.982
200	200	635	1210	0.43	2.510204	12	16	20	3	23.641
200	200	635	1210	0.43	2.510204	12	16	20	7	31.24
200	200	635	1210	0.43	2.510204	12	16	20	28	41.583
200	200	635	1210	0.43	2.510204	12	16	20	60	42.005
200	200	635	1210	0.43	2.510204	12	16	20	120	44.327
200	200	635	1210	0.43	2.510204	12	16	20	180	46.016
407	0	610	1220	0.399975	2.500108	8	0	0	14	16.254
366.3	40.7	610	1220	0.399975	2.500108	8	0	0	14	32.334
325.6	81.4	610	1220	0.399975	2.500108	8	0	0	14	36.83

284.9	122.1	610	1220	0.399975	2.500108	8	0	0	14	39.769
244.2	162.8	610	1220	0.399975	2.500108	8	0	0	14	41.499
203.5	203.5	610	1220	0.399975	2.500108	8	0	0	14	46.686
162.8	244.2	610	1220	0.399975	2.500108	8	0	0	14	52.911
407	0	610	1220	0.399975	2.500108	8	0	0	28	21.614
366.3	40.7	610	1220	0.399975	2.500108	8	0	0	28	36.311
325.6	81.4	610	1220	0.399975	2.500108	8	0	0	28	39.424
284.9	122.1	610	1220	0.399975	2.500108	8	0	0	28	43.228
244.2	162.8	610	1220	0.399975	2.500108	8	0	0	28	45.994
203.5	203.5	610	1220	0.399975	2.500108	8	0	0	28	50.317
162.8	244.2	610	1220	0.399975	2.500108	8	0	0	28	56.369
271.6	38.8	620.8	1221	0.625	2.508137	12	0	0.28	28	51.1
271.6	38.8	620.8	1662	0.625	2.508137	12	0	0.28	28	53.2
300	100	630	1150	0.122	2.485714	7	0	81.04		44.19
280	120	630	1150	0.035	0	7	0	100.32		53.29
360	40	651	1209	0.4	2.501094	14	0	0	7	27
320	80	651	1209	0.4	2.501094	14	0	0	28	40
360	40	651	1209	0.4	1.5	14	0	0	56	45
320	80	651	1209	0.4	1.5	14	0	0	90	47
360	40	651	1209	0.4	2.501094	14	0	0	7	31
320	80	651	1209	0.4	2.501094	14	0	0	28	47
360	40	651	1209	0.4	1.5	14	0	0	56	50
320	80	651	1209	0.4	1.5	14	0	0	90	54
360	40	651	1209	0.4	2.501094	14	0	0	7	25
320	80	651	1209	0.4	2.501094	14	0	0	28	43
360	40	651	1209	0.4	1.5	14	0	0	56	50
320	80	651	1209	0.4	1.5	14	0	0	90	52
360	40	651	1209	0.4	2.501094	14	0	0	7	29
320	80	651	1209	0.4	2.501094	14	0	0	28	54
360	40	651	1209	0.4	1.5	14	0	0	56	63
320	80	651	1209	0.4	1.5	14	0	0	90	68
360	40	651	1209	0.4	2.501094	14	0	0	7	36
320	80	651	1209	0.4	2.501094	14	0	0	28	48
360	40	651	1209	0.4	1.5	14	0	0	56	56
320	80	651	1209	0.4	1.5	14	0	0	90	62
440.36	0	568	852	0.349714	2.5	8	6.61	0	7	15.6
396.32	44.036	568	852	0.349717	2.5	8	6.61	0	7	20.3
352.29	88.072	568	852	0.349712	2.5	8	6.61	0	7	26
308.25	132.11	568	852	0.349714	2.5	8	6.61	0	7	31.5
440.36	0	568	852	0.349714	2.5	10	6.61	0	7	18.6
396.32	44.036	568	852	0.349717	2.5	10	6.61	0	7	22.6
352.29	88.072	568	852	0.349712	2.5	10	6.61	0	7	27.8
308.25	132.11	568	852	0.349714	2.5	10	6.61	0	7	33.2
440.36	0	568	852	0.349714	2.5	12	6.61	0	7	21.8
396.32	44.036	568	852	0.349717	2.5	12	6.61	0	7	25.7
352.29	88.072	568	852	0.349712	2.5	12	6.61	0	7	31.9
308.25	132.11	568	852	0.349714	2.5	12	6.61	0	7	35.4
440.36	0	568	852	0.349714	2.5	8	6.61	0	28	18.9
396.32	44.036	568	852	0.349717	2.5	8	6.61	0	28	24.3
352.29	88.072	568	852	0.349712	2.5	8	6.61	0	28	30.8
308.25	132.11	568	852	0.349714	2.5	8	6.61	0	28	33.9
440.36	0	568	852	0.349714	2.5	10	6.61	0	28	22.3
396.32	44.036	568	852	0.349717	2.5	10	6.61	0	28	26.8
352.29	88.072	568	852	0.349712	2.5	10	6.61	0	28	31.8
308.25	132.11	568	852	0.349714	2.5	10	6.61	0	28	36.3
440.36	0	568	852	0.349714	2.5	12	6.61	0	28	25.9
396.32	44.036	568	852	0.349717	2.5	12	6.61	0	28	30.3
352.29	88.072	568	852	0.349712	2.5	12	6.61	0	28	35.9
308.25	132.11	568	852	0.349714	2.5	12	6.61	0	28	38.9
44.87	19.23	57.01	132.26	0.146178	5.00641	6	0	0	3	14.136
44.87	19.23	57.01	132.26	0.146178	5.00641	6	0	0	7	20.242
44.87	19.23	57.01	132.26	0.146178	5.00641	6	0	0	14	23.918
44.87	19.23	57.01	132.26	0.146178	5.00641	6	0	0	28	24.766

38.46	25.64	57.01	132.26	0.153666	3.828431	8	0	0	3	17.359
38.46	25.64	57.01	132.26	0.153666	3.828431	8	0	0	7	21.373
38.46	25.64	57.01	132.26	0.153666	3.828431	8	0	0	14	24.653
38.46	25.64	57.01	132.26	0.153666	3.828431	8	0	0	28	26.745
32.05	32.05	57.01	132.26	0.163027	2.958333	10	0	0	3	18.32
32.05	32.05	57.01	132.26	0.163027	2.958333	10	0	0	7	23.635
32.05	32.05	57.01	132.26	0.163027	2.958333	10	0	0	14	27.141
32.05	32.05	57.01	132.26	0.163027	2.958333	10	0	0	28	29.12
25.64	38.46	57.01	132.26	0.170515	2.503205	12	0	0	3	21.656
25.64	38.46	57.01	132.26	0.170515	2.503205	12	0	0	7	26.066
25.64	38.46	57.01	132.26	0.170515	2.503205	12	0	0	14	29.628
25.64	38.46	57.01	132.26	0.170515	2.503205	12	0	0	28	31.947
19.23	44.87	57.01	132.26	0.178003	2.169444	14	0	0	3	24.313
19.23	44.87	57.01	132.26	0.178003	2.169444	14	0	0	7	27.706
19.23	44.87	57.01	132.26	0.178003	2.169444	14	0	0	14	32.003
19.23	44.87	57.01	132.26	0.178003	2.169444	14	0	0	28	33.473
343	147	490	1470	0.463265	2.109589	12	3.92	0	3	8.683
343	146.265	490	1470	0.463961	2.109589	12	3.92	0	3	9.071
343	145.53	490	1470	0.464659	2.109589	12	3.92	0	3	9.201
343	144.795	490	1470	0.465359	2.109589	12	3.92	0	3	10.238
343	144.06	490	1470	0.466062	2.109589	12	3.92	0	3	11.533
343	143.325	490	1470	0.466766	2.109589	12	3.92	0	3	11.404
343	147	490	1470	0.463265	2.109589	12	3.92	0	7	30.454
343	146.265	490	1470	0.463961	2.109589	12	3.92	0	7	29.806
343	145.53	490	1470	0.464659	2.109589	12	3.92	0	7	30.713
343	144.795	490	1470	0.465359	2.109589	12	3.92	0	7	29.935
343	144.06	490	1470	0.466062	2.109589	12	3.92	0	7	30.583
343	143.325	490	1470	0.466766	2.109589	12	3.92	0	7	28.639
343	147	490	1470	0.463265	2.109589	12	3.92	0	14	50.799
343	146.265	490	1470	0.463961	2.109589	12	3.92	0	14	51.706
343	145.53	490	1470	0.464659	2.109589	12	3.92	0	14	49.762
343	144.795	490	1470	0.465359	2.109589	12	3.92	0	14	52.484
343	144.06	490	1470	0.466062	2.109589	12	3.92	0	14	51.706
343	143.325	490	1470	0.466766	2.109589	12	3.92	0	14	52.613
343	147	490	1470	0.463265	2.109589	12	3.92	0	28	52.354
343	146.265	490	1470	0.463961	2.109589	12	3.92	0	28	51.706
343	145.53	490	1470	0.464659	2.109589	12	3.92	0	28	54.557
343	144.795	490	1470	0.465359	2.109589	12	3.92	0	28	55.205
343	144.06	490	1470	0.466062	2.109589	12	3.92	0	28	54.557
343	143.325	490	1470	0.466766	2.109589	12	3.92	0	28	55.076
343	147	490	1470	0.463265	2.109589	12	3.92	0	3	9.353
343	146.265	490	1470	0.463961	2.109589	12	3.92	0	3	11.466
343	145.53	490	1470	0.464659	2.109589	12	3.92	0	3	9.957
343	144.795	490	1470	0.465359	2.109589	12	3.92	0	3	13.125
343	144.06	490	1470	0.466062	2.109589	12	3.92	0	3	13.879
343	143.325	490	1470	0.466766	2.109589	12	3.92	0	3	12.974
343	147	490	1470	0.463265	2.109589	12	3.92	0	7	33.19
343	146.265	490	1470	0.463961	2.109589	12	3.92	0	7	29.267
343	145.53	490	1470	0.464659	2.109589	12	3.92	0	7	28.362
343	144.795	490	1470	0.465359	2.109589	12	3.92	0	7	33.944
343	144.06	490	1470	0.466062	2.109589	12	3.92	0	7	35
343	143.325	490	1470	0.466766	2.109589	12	3.92	0	7	33.793
343	147	490	1470	0.463265	2.109589	12	3.92	0	14	54.914
343	146.265	490	1470	0.463961	2.109589	12	3.92	0	14	58.685
343	145.53	490	1470	0.464659	2.109589	12	3.92	0	14	56.724
343	144.795	490	1470	0.465359	2.109589	12	3.92	0	14	59.741
343	144.06	490	1470	0.466062	2.109589	12	3.92	0	14	56.724
343	143.325	490	1470	0.466766	2.109589	12	3.92	0	14	57.78
343	147	490	1470	0.463265	2.109589	12	3.92	0	28	56.422
343	146.265	490	1470	0.463961	2.109589	12	3.92	0	28	60.194
343	145.53	490	1470	0.464659	2.109589	12	3.92	0	28	57.328
343	144.795	490	1470	0.465359	2.109589	12	3.92	0	28	62.909
343	144.06	490	1470	0.466062	2.109589	12	3.92	0	28	58.685

343	143.325	490	1470	0.466766	2.109589	12	3.92	0	28	55.517
405	0	683	1269	0.4	1	13	0	81	7	21.5
405	0	683	1269	0.4	1	13	0	81	14	25.42
405	0	683	1269	0.4	1	13	0	81	28	28.357
405	0	683	1269	0.4	1	13	0	81	42	28.69
405	0	683	1269	0.4	1	13	0	81	56	29.024
303.75	101.25	683	1269	0.4	1	13	0	81	7	24.405
303.75	101.25	683	1269	0.4	1	13	0	81	14	29.119
303.75	101.25	683	1269	0.4	1	13	0	81	28	32.167
303.75	101.25	683	1269	0.4	1	13	0	81	42	32.643
303.75	101.25	683	1269	0.4	1	13	0	81	56	32.929
202.5	202.5	683	1269	0.4	1	13	0	81	7	22.929
202.5	202.5	683	1269	0.4	1	13	0	81	14	26.452
202.5	202.5	683	1269	0.4	1	13	0	81	28	29.595
202.5	202.5	683	1269	0.4	1	13	0	81	42	30
202.5	202.5	683	1269	0.4	1	13	0	81	56	30.262
101.25	303.75	683	1269	0.4	1	13	0	81	7	21.643
101.25	303.75	683	1269	0.4	1	13	0	81	14	25.119
101.25	303.75	683	1269	0.4	1	13	0	81	28	28.405
101.25	303.75	683	1269	0.4	1	13	0	81	42	28.976
101.25	303.75	683	1269	0.4	1	13	0	81	56	29.357