

COMPARISON OF LOAD V/S DEFROMATION OF SHORT COLUMN BY USING MATLAB SOFTWARE

Abstract

The purpose of the project work is to comparison of load v/s deformation of short column made by reinforced cement concrete when they are subjected to concentric compression. The analysis of the reinforced cement concrete column is done by a Finite Element Software known as MATLAB in that ANN Tool (Artificial neural network). The input data for the software were collected from the experiments conducted on columns and the lateral ties are provided according to IS:456-2000 at clause number 26.5.3.2(c). As the studies are made limited on this comparison of load v/s deformation of short column, we are affordable with limited number of literatures. comparison of load v/s deformation of short column are depending upon wrong assumptions on model used for the analysis, and the results are very much conservative, and the empirical conservative rules are essential for the technical codes. In this research, the analysis is done through MATLAB software. The analysis is done for Normal strength concrete Column (NSC) of mix proportion of M- 20, M-30, M-40grade concrete. The analysis of physical model and deformation values are obtained very accurately with minimized errors. Finally, it shows the MATLAB software displaying the deformation results specifically.

Keywords: MATLAB; Artificial Neural Network; Concentric.

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I. INTRODUCTION

A reinforced concrete column is defined as a structural member with a steel frame [Reinforcement's] composed of concrete that is been designed to carry the compressive loads. Stiffness of building frames. Main reinforcement in columns is longitudinal, parallel to the direction of the axial load, and bars are arranged in square, circular or circular pattern. Design of columns consists of compression and bending moments about one or both axes of the cross section. Generally, columns are the supporting elements for every kind of structural bodies. Column carry the load from beams from the superstructure's and it will transfer the load to the sub-structure. Steel rebars are embedded into column to be as reinforcement. It may be provided in the tied form or the helical form. Column characteristics are depending upon the factors like slenderness ratio, stiffness, young's modulus, characteristic compressive strength. Generally, the compressive strength of Normal Strength Concrete is below 50 N/mm². The other name for NSC are namely Conventional Concrete or Ordinary Portland Concrete or Traditional Vibrated Concrete. The main constituents used in manufacturing NSC are ordinary Portland cement, water, fine and coarse aggregate. The proportioning of concrete is done with guidelines given by IS:10262-2009. De-Bonding takes place in cement paste from the aggregates particles due to compression failure. MATLAB stands for MATrix laboratory. It provides easy access for the matrix developed through LINPACK (Linear system package) & EISPACK (Eigen system package) projects. It's a computing language. For the technical computing this is one of the high computing language. It mainly includes the techniques like computation, visualization and programming. This is one of the modern programming language used in prediction. It supports the object-oriented programming, debugging tools and built-in editing options. MATLAB is well versed for the research work and even for teaching also. The data which is required for the MATLAB doesn't required any dimensioning system. If we see the history it was launched in the ear 1984 and later on it became an effective tool around the world. Its built-in advancement also provides the variety of computational technique. Its graphic design is such effective, it helps in generation of results immediatly and effectively visible.

II. MATERIALS AND METHODS

MATERIALS

1. **Cement:** OPC: Ordinary Portland Cement of 53 grade.
2. **Fine Aggregate:** M. Sand of Zone II.
3. **Coarse Aggregate:** 20mm downsize Aggregates.
4. **Water:** Portable water.
5. **Steel:** 8mm,10mm,12mm & 16mm TMT bars were used

Table 1: Specific Gravity of Constituents

Sl. No	Material	Specific Gravity	IS Codal Limits	Related IS Code
1.	Cement	3.15	3.15	IS:2720 Part - 3
2.	Fine aggregate	2.57	2.5 – 2.9	IS:2386(Part-3):1963
3.	Coarse aggregate	2.65	2.6 - 3	IS:2386(Part-3):1963

Table 2: Mix Proportion for NSC M-20,M-30,M-40

Materials	Proportion-M-20	Proportion-M-30	Proportion-M-40
Cement (kg/m ³)	358.47	383.16	465
Fine aggregates (kg/m ³)	690.68	670.72	650.80
Coarse aggregates (kg/m ³)	1113.93	1128.41	1094.89
Water (lit/m ³)	197.16	191.58	186
Water cement ratio	0.55	0.5	0.40
Cube compressive strength (28 days) N/mm ²	27.23	36.28	49.61

METHODOLOGY

1. Collecting the experimental data and using it as inputs for MATLAB
2. Importing the input and results into the MATLAB to perform Artificial Neural Network (ANN) techniques.
3. Compare the MATLAB results using experimental results. 4. Finally compare the experimental results to know the shear behavior.

III.RESULT AND DISCUSSION

This Chapter includes the experimental data's of column casted for different concrete mixes like NSC(Normal Strength Concrete), of mix proportion M-20, M-30 & M40. With Main bar reinforcements 8mm, 10mm,12mm and 16mm diameter with 8mm diameter Lateral ties and results compared with the MATLAB/ANN results.

Table 3: Experimental Result Data's of NSC Columns

Critical Load Pcr(kN)	Critical Deformation Δcr(mm)	Load Py (kN)	Deformation Δy(mm)	Ultimate Load Pu(kN)	Ultimate Deformation Δu(mm)
301.50	4.50	351.75	6.05	502.50	10.68
317.92	4.88	370.90	6.34	529.86	10.36
333.27	5.32	388.82	6.4	555.45	9.72
255.42	3.97	297.99	5.4	425.70	11.32
270.27	4.42	315.32	6.19	450.45	10.60
284.85	4.96	332.33	6.4	474.75	9.91
221.88	6.06	258.86	7.2	369.80	12.54
234.96	5.77	274.12	6.6	391.60	11.00
247.43	6.12	288.67	7.1	412.39	10.54
310.76	4.40	362.56	5.29	517.94	9.20
330.81	4.96	385.95	5.4	551.35	8.80
348.45	5.14	406.53	5.9	580.75	8.21
269.28	4.21	314.16	6.1	448.80	9.68

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284.52	4.62	331.94	5.1	474.20	9.24
300.30	4.76	350.35	5.6	500.50	8.68
234.90	4.26	274.05	7.7	391.50	10.20
248.70	4.71	290.15	5.6	414.50	9.46
262.02	5.17	305.69	6.18	436.70	8.90
320.76	3.80	374.22	4.4	534.60	6.84
338.88	4.30	395.36	4.51	564.80	6.54
357.42	4.22	416.99	4.62	595.70	6.04
273.24	4.21	318.78	4.5	455.40	7.20
288.12	4.10	336.14	4.9	480.20	7.10
304.50	3.91	355.25	4.5	507.50	6.23
239.10	3.58	278.95	4.17	398.50	7.45
255.30	3.89	297.85	4.32	425.50	7.30
267.12	4.05	311.64	4.5	445.20	6.78
340.68	3.06	397.46	3.38	567.80	5.20
362.70	3.30	423.15	3.55	604.50	4.80
383.88	2.98	447.86	3.21	639.80	4.56
294.48	2.76	343.56	3.42	490.80	5.64
312.90	3.27	365.05	3.48	521.50	5.10
329.76	3.30	384.72	3.56	549.60	4.69
256.50	3.29	299.25	4	427.50	6.30
273.75	3.00	319.38	3.48	456.25	5.65
288.12	2.91	336.14	3.65	480.20	5.20

Table 4: MATLAB Result Data's of NSC Columns

Critical Load Pcr(kN)	Critical Deformation Δ_{cr} (mm)	Load P _y (kN)	Deformation Δ_y (mm)	Ultimate Load P _u (kN)	Ultimate Deformation Δ_u (mm)
303.19	4.78	353.63	6.12	505.24	10.33
319.90	5.05	373.11	5.96	533.07	9.81
335.61	5.21	391.42	6.14	559.24	9.29
260.80	4.86	304.18	6.35	434.60	10.76
277.51	5.13	323.66	6.19	462.43	10.24
293.22	5.29	341.97	6.37	488.60	9.72
218.41	4.94	254.73	6.58	363.96	11.19
235.12	5.21	274.21	6.42	391.79	10.67
250.83	5.37	292.52	6.60	417.96	10.15
310.57	4.41	362.24	5.58	517.54	9.33
327.28	4.68	381.72	5.41	545.37	8.82
342.99	4.83	400.03	5.60	571.54	8.30
268.18	4.49	312.79	5.81	446.90	9.76
284.89	4.76	332.27	5.64	474.73	9.25

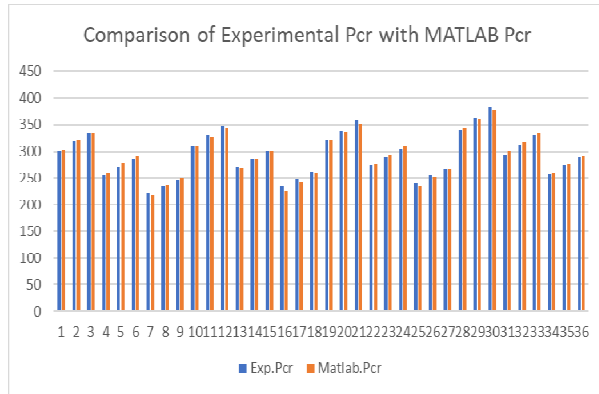
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300.60	4.91	350.58	5.83	500.90	8.73
225.79	4.57	263.34	6.04	376.26	10.19
242.50	4.84	282.82	5.87	404.09	9.68
258.21	4.99	301.13	6.06	430.26	9.16
319.59	3.95	372.76	4.92	532.58	8.12
336.29	4.22	392.24	4.75	560.41	7.60
352.01	4.37	410.55	4.94	586.58	7.08
277.20	4.03	323.31	5.15	461.94	8.55
293.90	4.30	342.79	4.98	489.77	8.03
309.62	4.45	361.10	5.17	515.94	7.51
234.81	4.11	273.86	5.38	391.30	8.98
251.51	4.38	293.34	5.21	419.13	8.46
267.23	4.53	311.65	5.40	445.30	7.94
342.75	2.78	399.78	3.22	571.18	4.99
359.46	3.05	419.27	3.05	599.01	4.48
375.17	3.20	437.58	3.24	625.18	3.96
300.36	2.86	350.33	3.45	500.54	5.42
317.07	3.13	369.82	3.28	528.37	4.91
332.78	3.28	388.13	3.47	554.54	4.39
257.97	2.94	300.88	3.68	429.90	5.85
274.68	3.21	320.37	3.51	457.73	5.34
290.39	3.36	338.68	3.70	483.90	4.82

- With reference to above table we can identify the error of maximum 8.37kN of Pcr b/w Experimental and MATLAB results.
- With reference to above table we can identify the error of maximum 0.89mm of Δ_{cr} b/w Experimental and MATLAB results.
- With reference to above table we can identify the error of maximum 9.64kN of Py b/w Experimental and MATLAB results.
- With reference to above table we can identify the error of maximum 1.21mm of Δ_y b/w Experimental and MATLAB results.
- With reference to above table we can identify the error of maximum 13.85kN of Pu b/w Experimental and MATLAB results.
- With reference to above table we can identify the error of maximum 1.52mm of Δ_u b/w Experimental and MATLAB results.

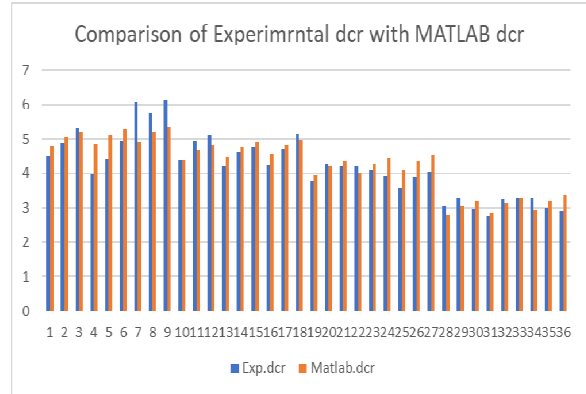
1. Comparison of NS C columns Experimental Results With MATLAB Results

Graph 1: Comparison of Experimental Pcr with MATLAB Pcr



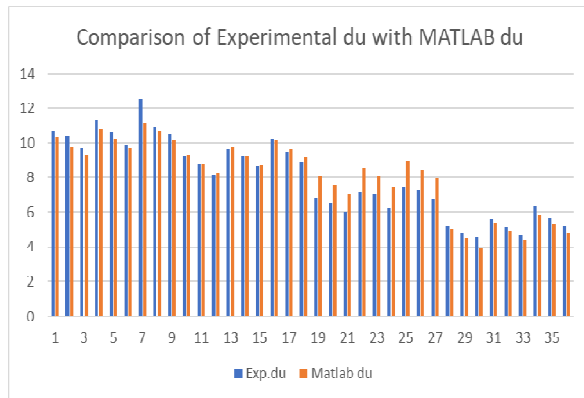
From the above graph it is observed that the variation in the critical Load of Experiment is almost nearer to the critical load obtained from MATLAB

Graph 2: Comparison of Experimental Δcr with MATLAB Δcr



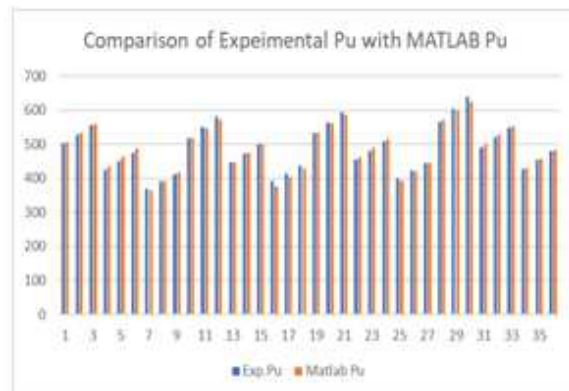
From the above graph it is observed that the variation in the critical deformation of Experiment and MATLAB are varied in high extent due to variation in network training.

Graph 3: Comparison of Experimental Δu with MATLAB Δu



From the above graph it is observed that the variation in the ultimate deformation in Experiment is comparatively higher than the MATLAB due to variation in network training

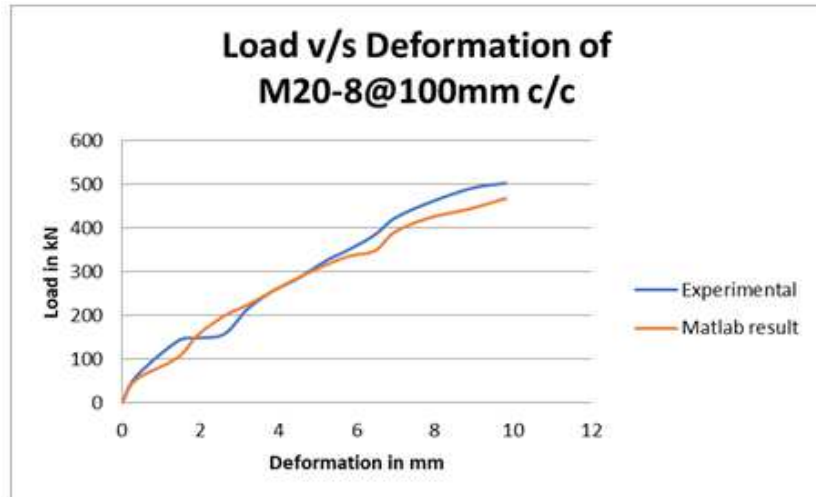
Graph 4: Comparison of Experimental Pu with MATLAB Pu



From the above graph it is observed that the variation in the ultimate load of Experiment is almost nearer to the ultimate load obtained from MATLAB.

2. Comparison of Load V/S Deformation Graph from Experimental with MATLAB of NSC Column

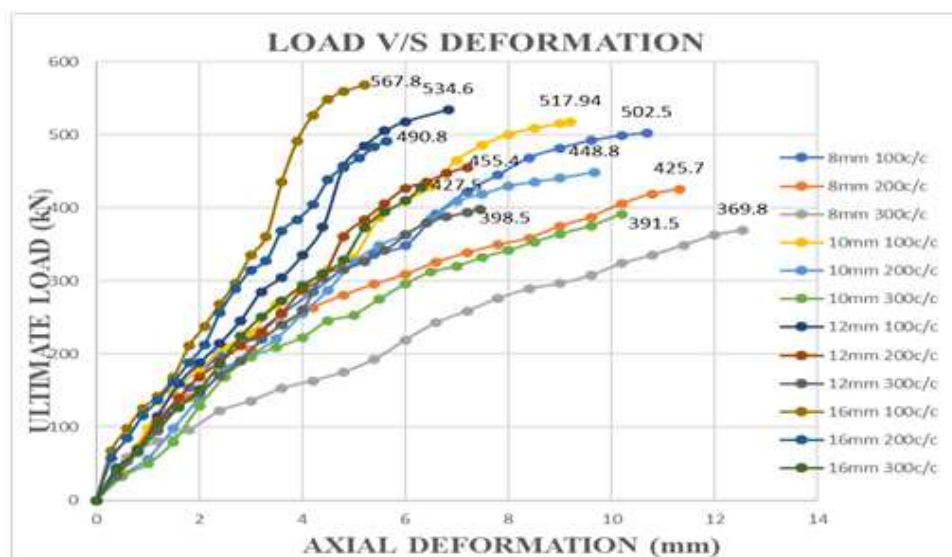
Graph 5: Comparison of Load V/S Deformation Graph from Experimental with MATLAB of NSC M20 Column



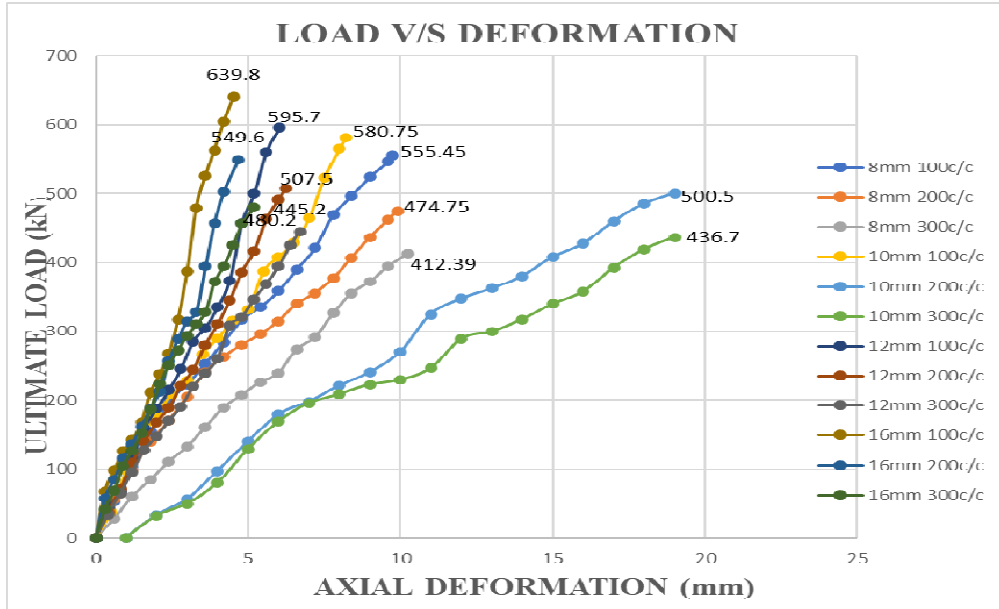
- From the above graph it is observed that the MATLAB curve is similar to the experimental curve.
- In experiment, load values are taken for regular intervals of deformation and in MATLAB the deformations and critical, yield load are obtained for ultimate 567.8 kN axial load.

3. Comparison of Load V/S Deformation Graph from Experimental with MATLAB of NSC Column

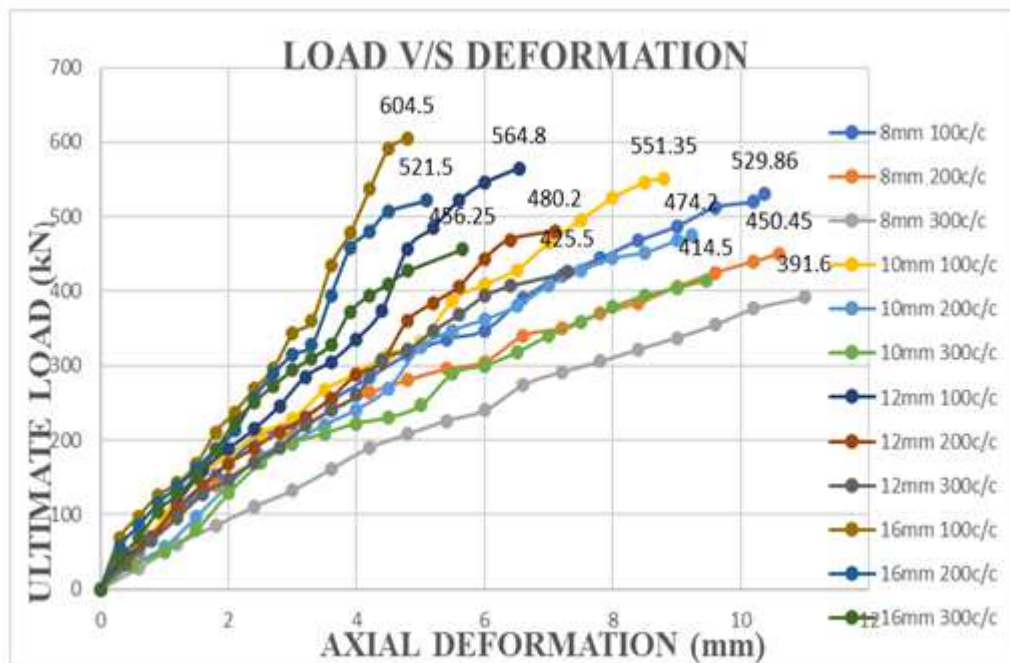
Graph 6: Comparison of Load V/S Deformation Graph from Experimental with MATLAB of NSCM-20 Column



Graph 7: Comparison of Load V/S Deformation Graph from Experimental with MATLAB of NSC M -30Column



Graph 8: Comparison of Load V/S Deformation Graph from Experimental with MATLAB of NSCM-40Column



IV. CONCLUSION

This investigation was conducted to find the shear behavior of various concrete mix columns like NSC [NORMAL STRENGTH CONCRETE] M-20,M-30,M-40.The

Reinforcement of column with main bar 8mm, 10mm,16mm dia meter with lateral ties of 8mm diameter spaced at100mm,200mm,300mm c/c bought to ss know the shear behavior r of different concrete mix columns.

1. Comparison of NSC-20 Column Experimental Results with MATLAB Results:

The total deformation of NSC-20 increases as the application of axial load increases.

- The above graph shows the similarity in the nature of curve of both MATLAB curve and experimental curve.
- The ultimate load of 567.8KN was found during experiment and same applied as the axial load in MATLAB.
- The ultimate deformation obtained from the experiment was recorded as12.54mm where as MATLAB provided 11.19mm as result.

2. Comparison of NSC -30 Column Experimental Results with MATLAB Results:

The total deformation of NSC-20 increases as the application of axial load increases.

- The above graph shows the similarity in the nature of curve of both MATLAB curve and experimental curve.
- The ultimate load of 604.5KN was found during experiment and same applied as the axial load in MATLAB.
- The ultimate deformation obtained from the experiment was recorded as10.20mm where as MATL.AB provided 10.19mm as result.

3. Comparison of NSC-40 Column Experimental Results with MATLAB Results:

The total deformation of NSC-40increases as the application of axial load increases.

- The above graph shows the similarity in the nature of curve of both MATLAB curve and experimental curve.
- The ultimate load of 639.8KN was found during experiment and same applied as the axial load in MATLAB.
- The ultimate deformation obtained from the experiment was recorded as7.45mm where as MATLAB provided 8.98mm as result.

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