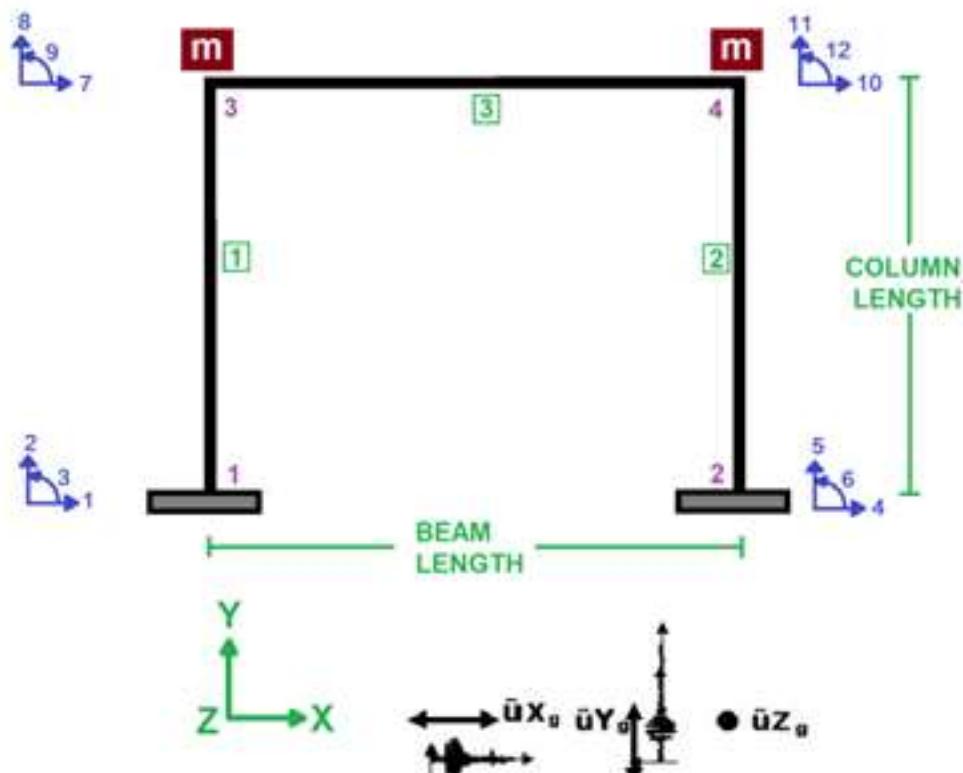


UNCERTAINTY ANALYSIS OF RC FRAMES. A PROBABILISTIC SEISMIC ASSESSMENT FRAMEWORK USING OPENSEES

THIS PROGRAM WRITTEN BY SALAR DELAVAR GHASHGHAEI (QASHQAI)

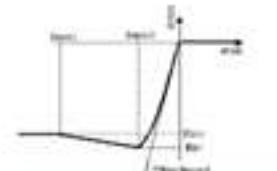


$$\text{Structure Ductility Damage Index} = \frac{\delta_d - \delta_y}{\delta_u - \delta_y}$$

δ_d = Lateral Displacement from Dynamic Analysis

δ_y = Lateral Yield Displacement from Pushover Analysis

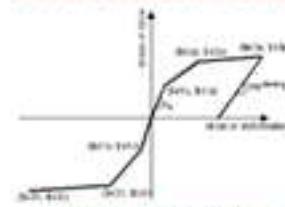
δ_u = Lateral Ultimate Displacement from Pushover Analysis



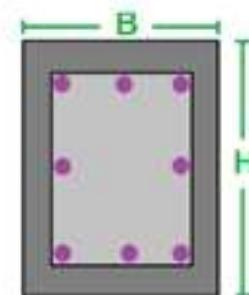
CORE AND COVER CONCRETE REALTION



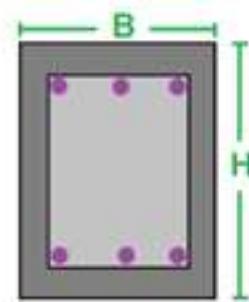
WITHOUT HARDENING AND ULTIMATE STRAIN



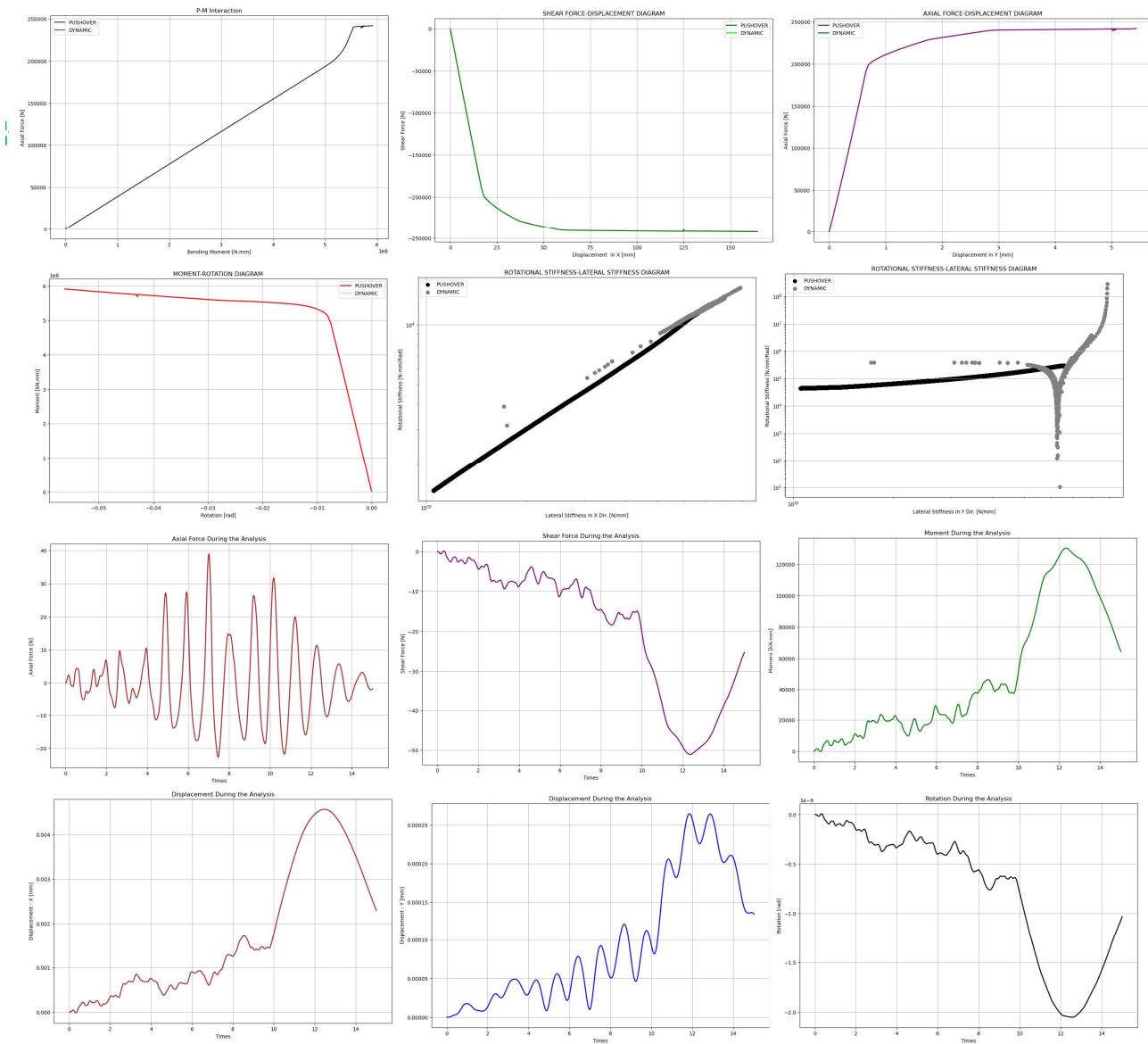
WITH HARDENING AND ULTIMATE STRAIN

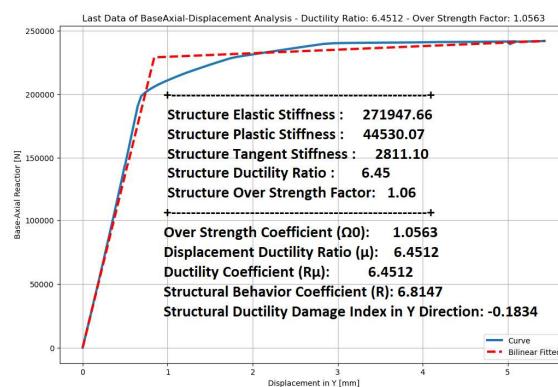
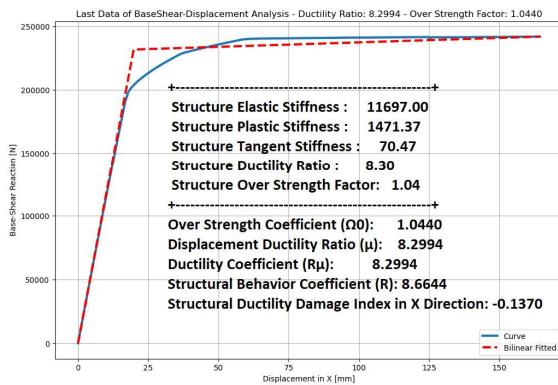
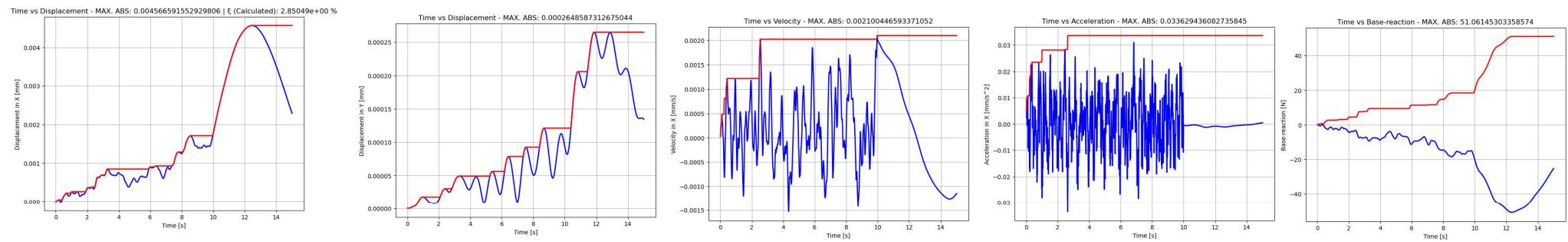


COLUMN SECTION

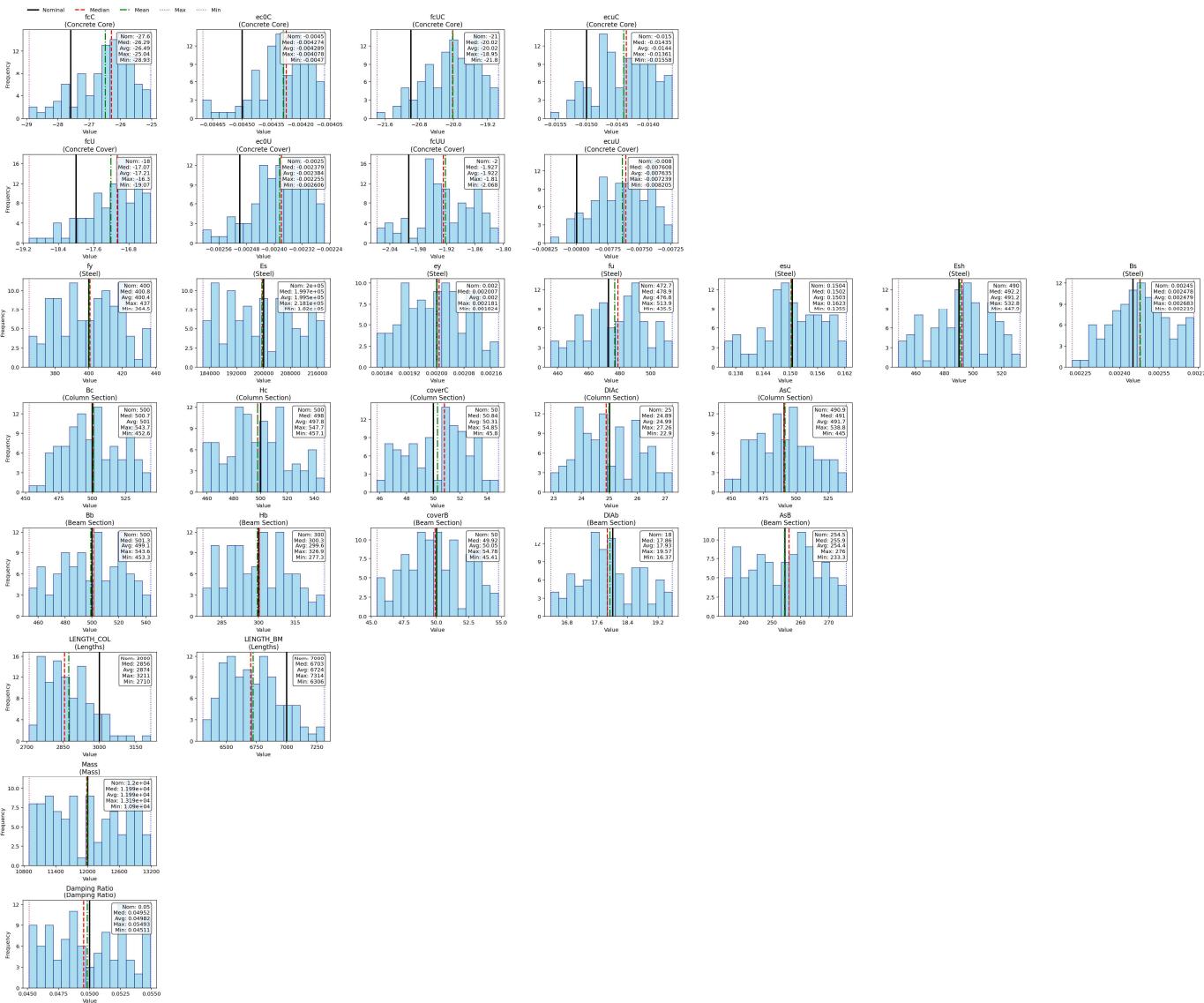


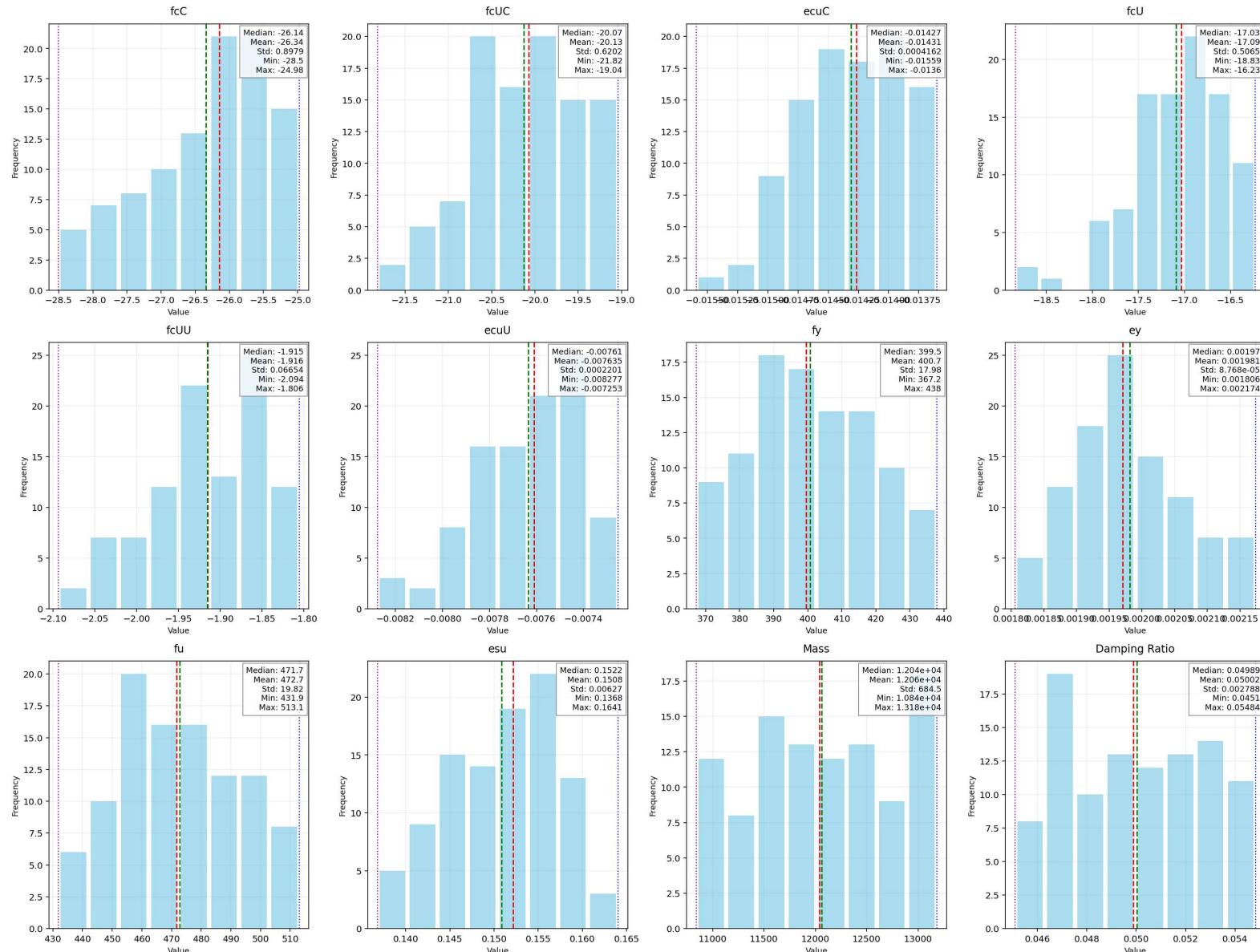
BEAM SECTION

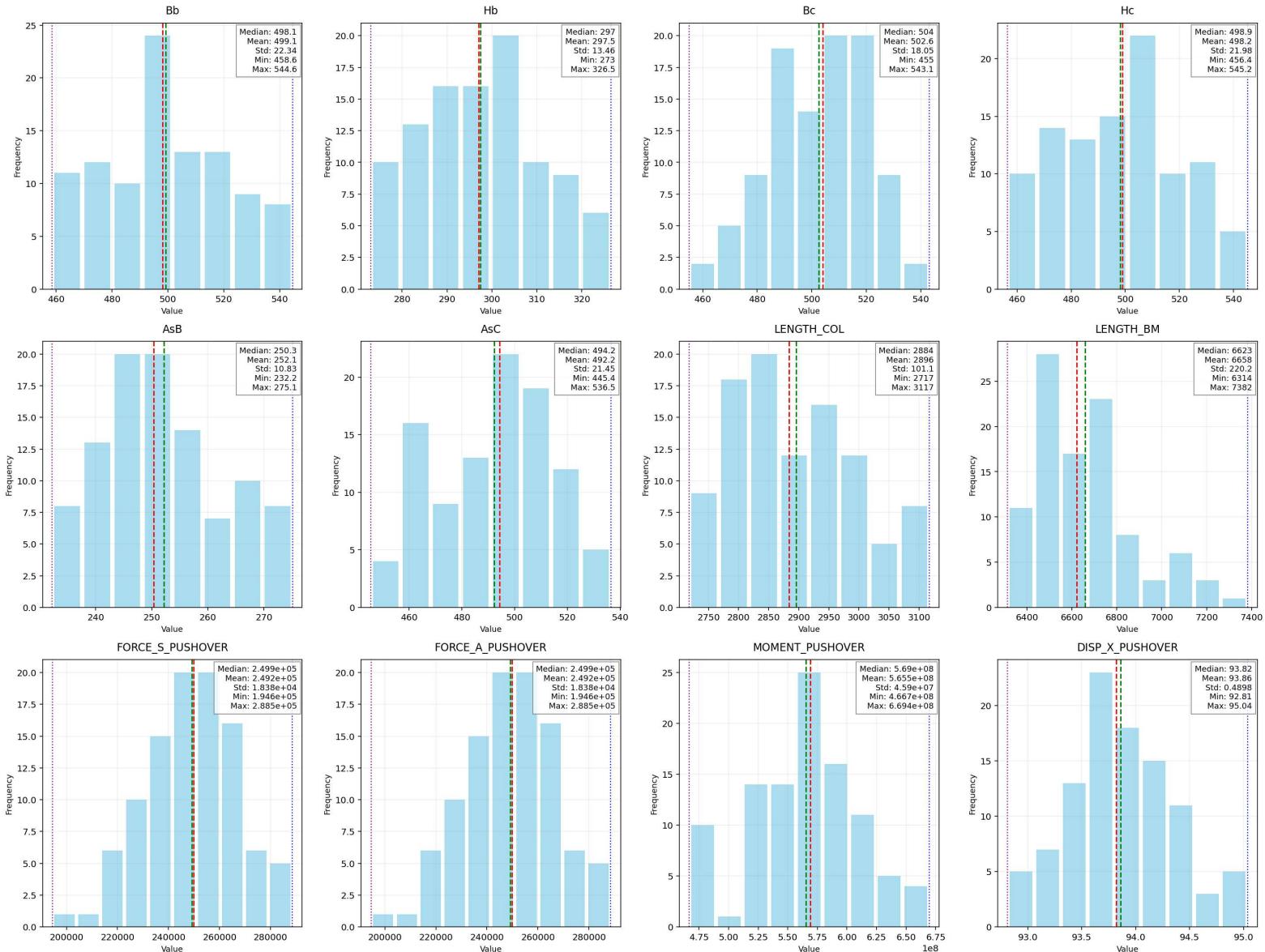


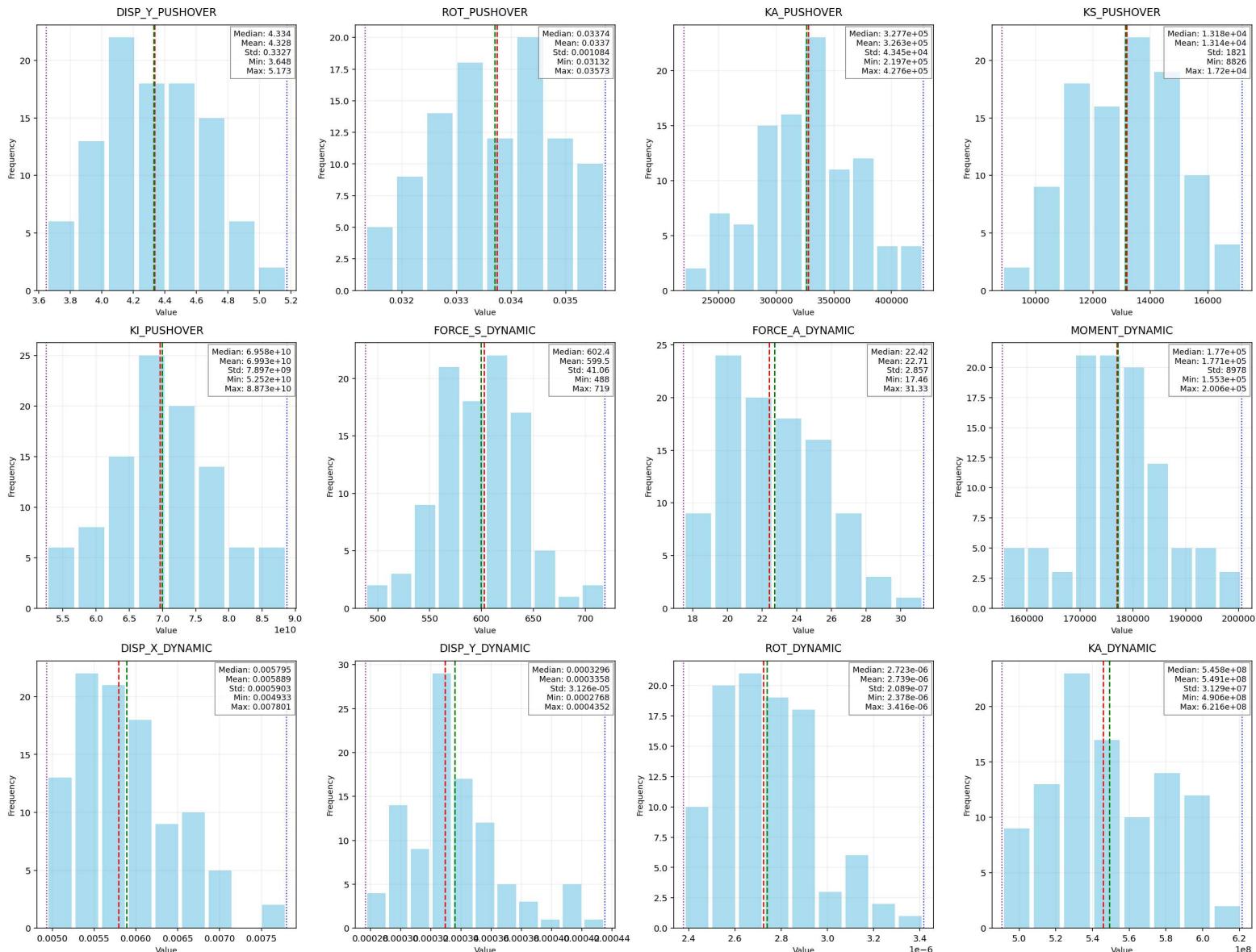


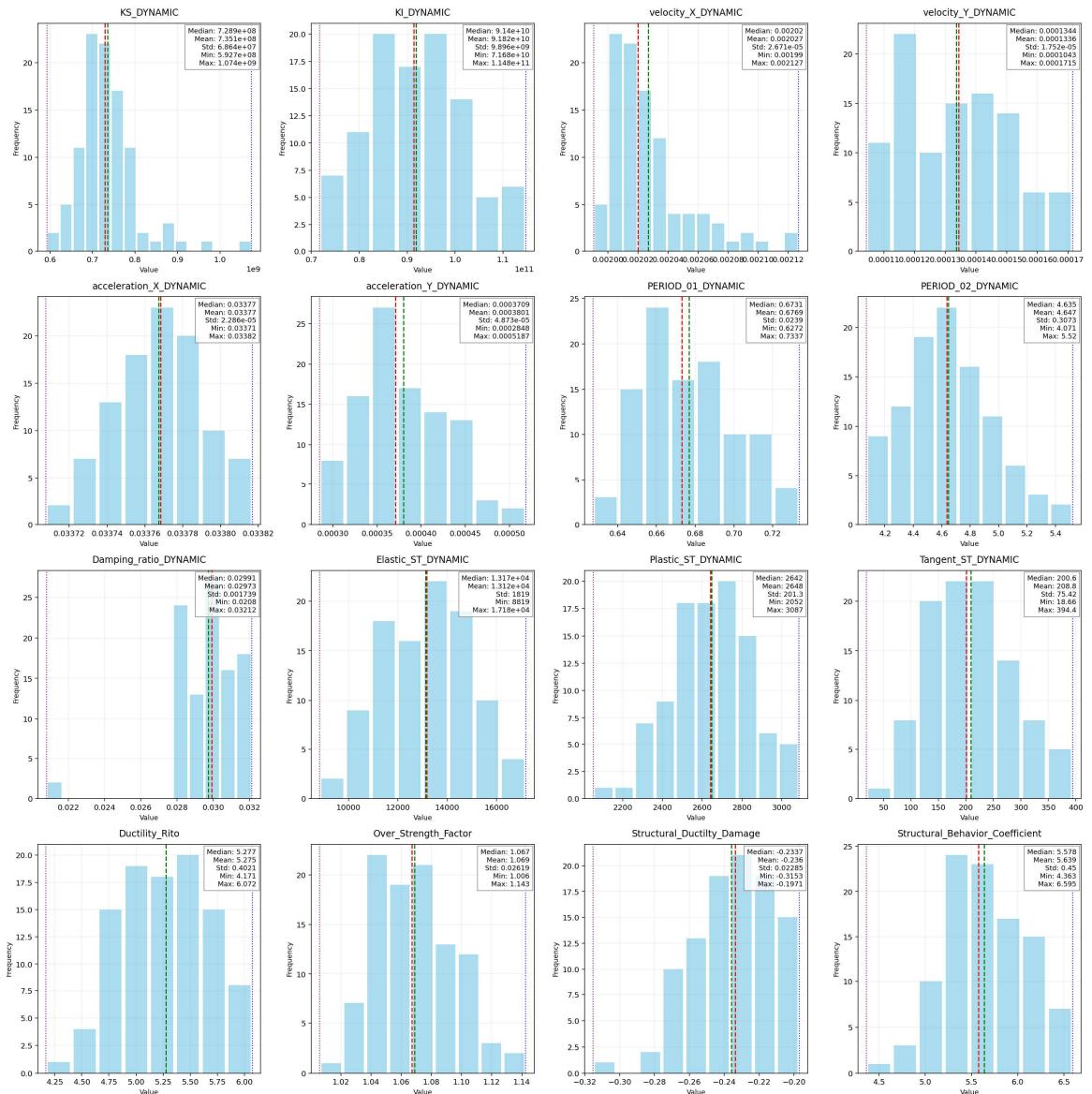
Parameter Distributions with Statistics (n=100)

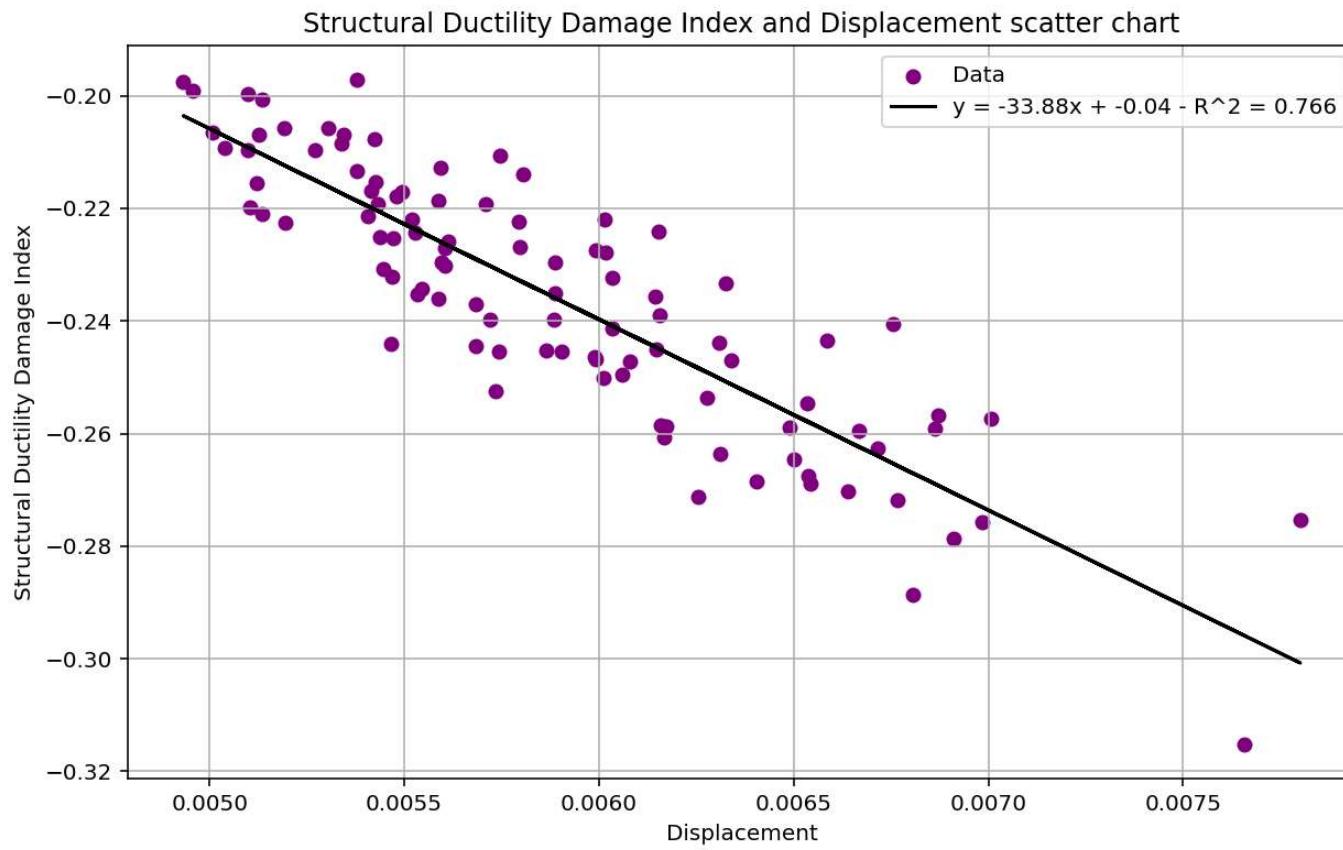




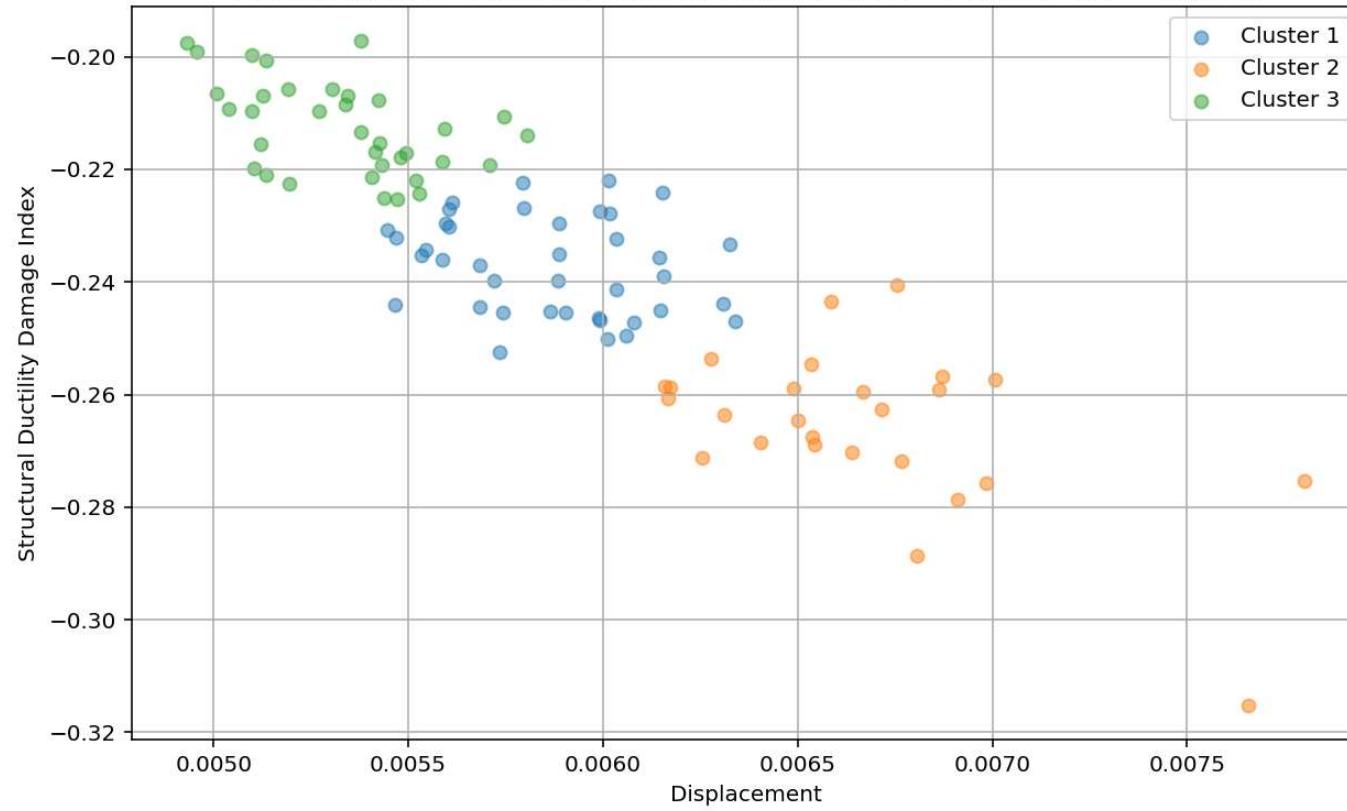




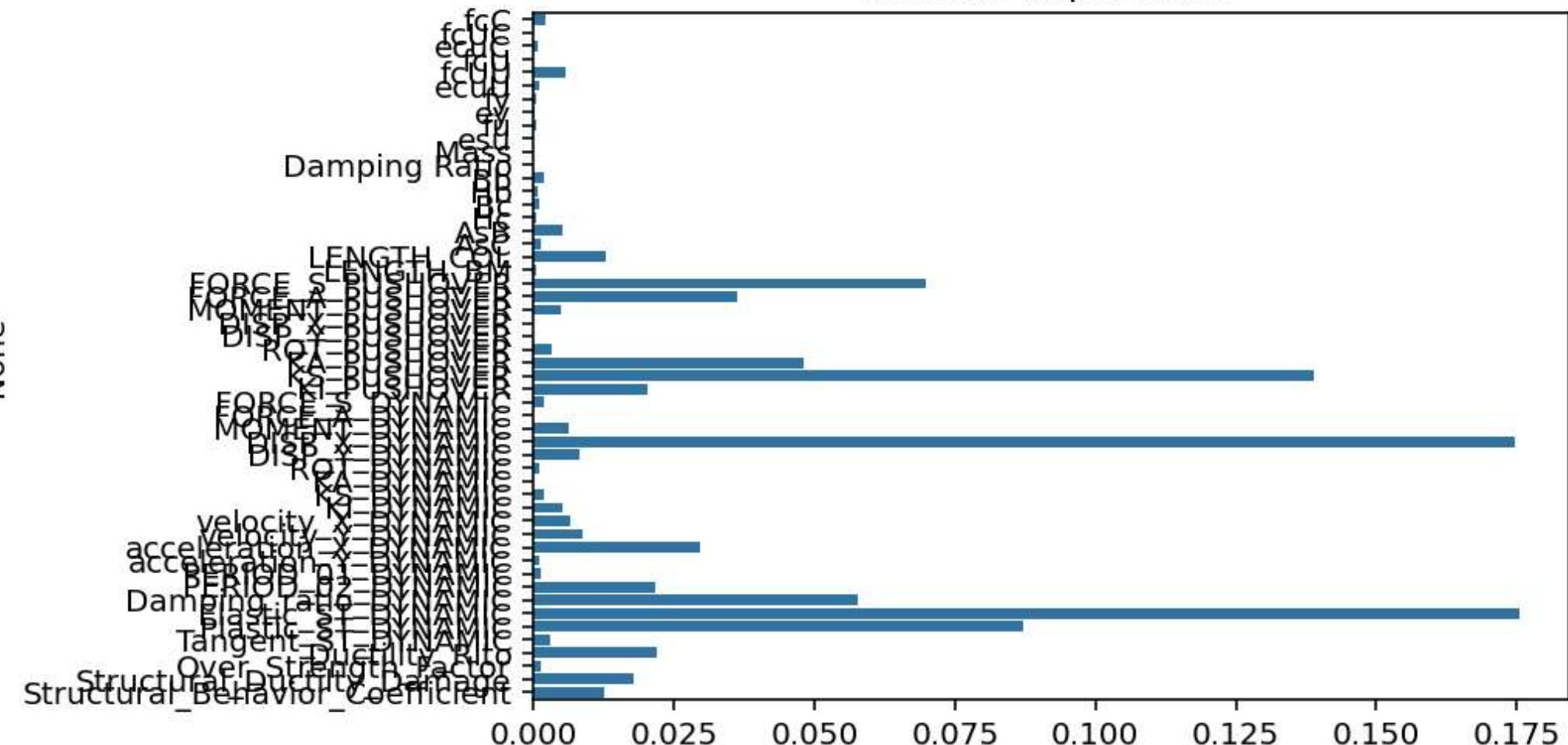




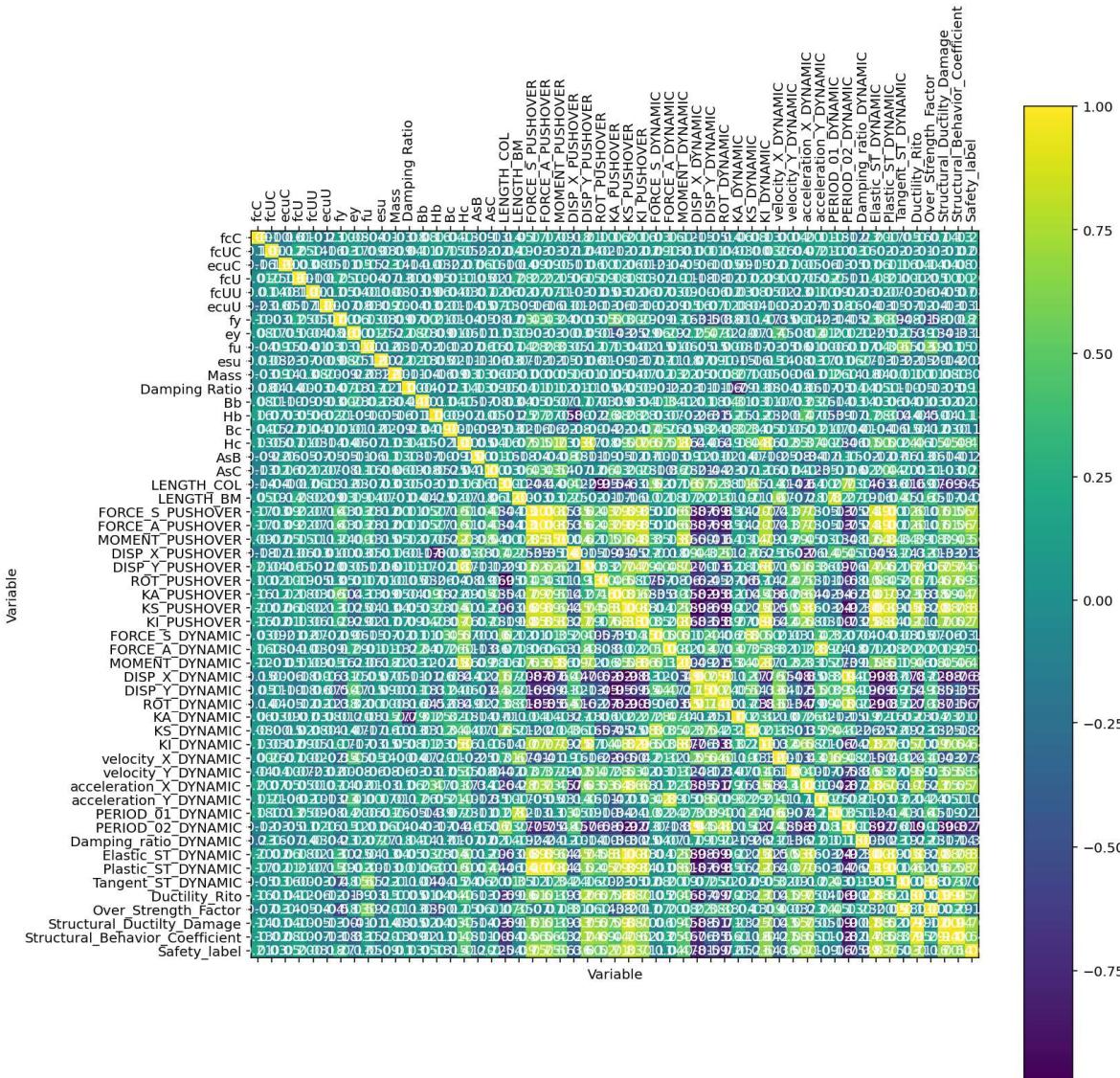
Displacement vs Structural Ductility Damage Index - 3 Clusters ($R^2 = 0.8437$)



Feature Importance



Correlation Heatmap



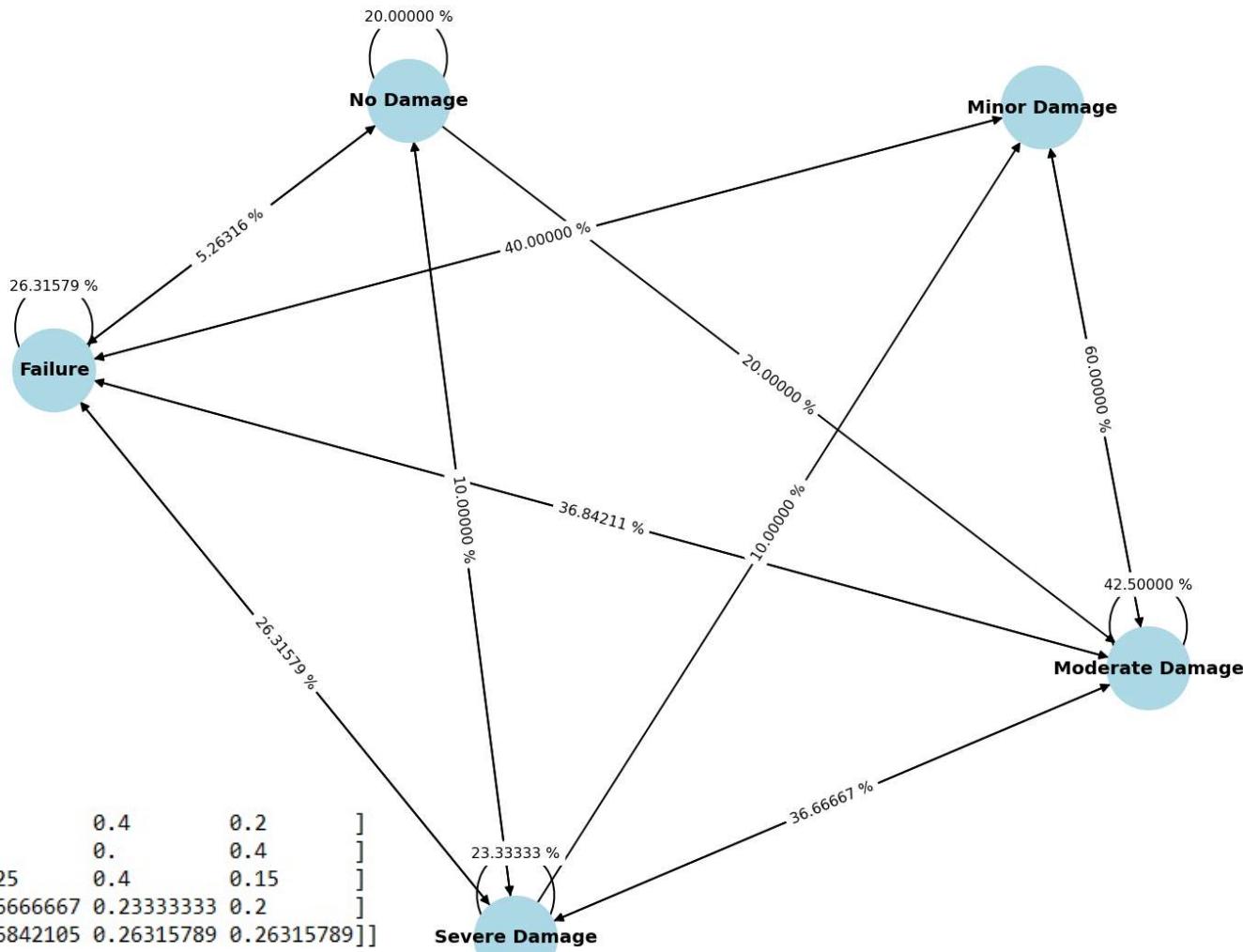
OLS Regression Results

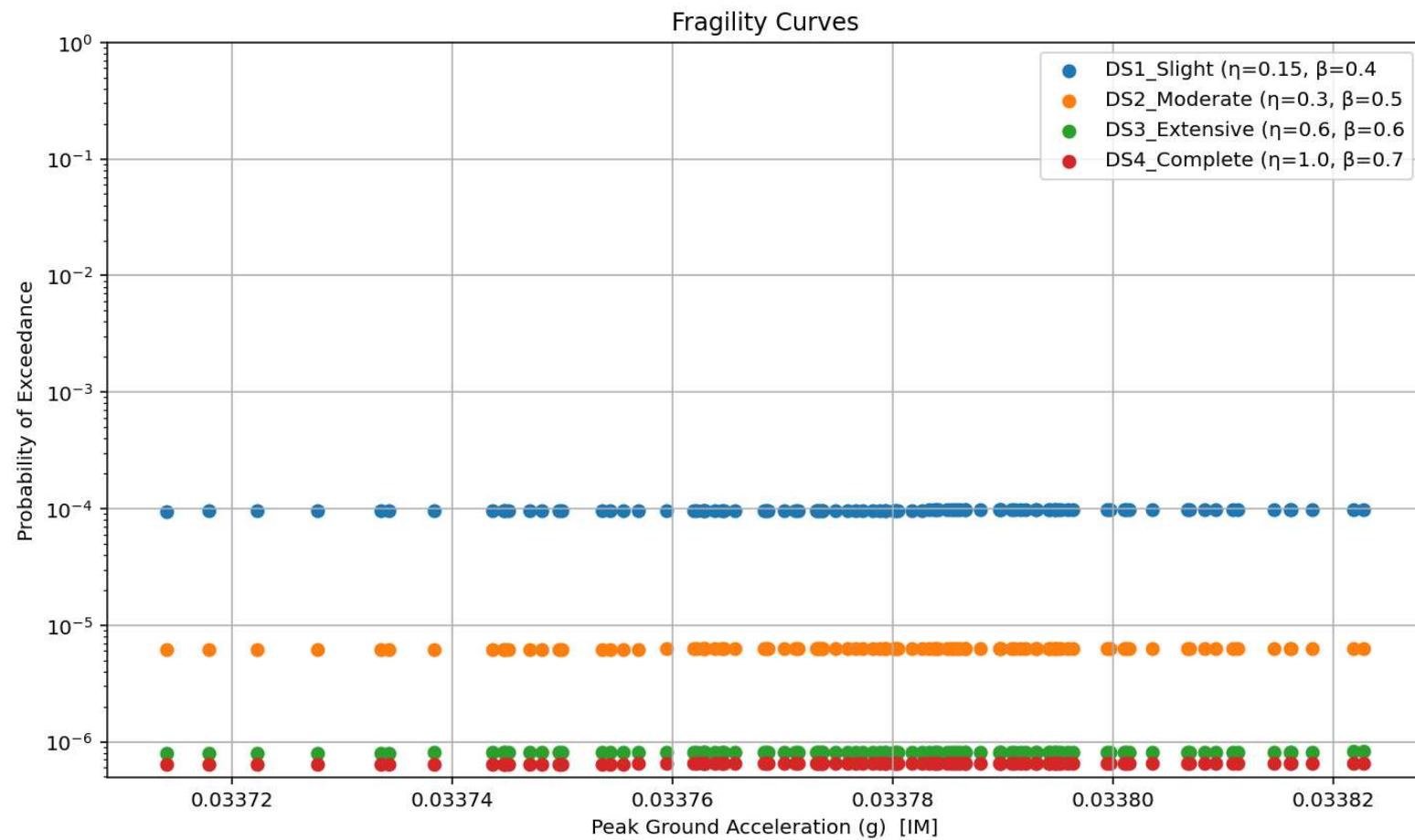
```
=====
Dep. Variable:      DISP_X_DYNAMIC   R-squared:          0.841
Model:                          OLS   Adj. R-squared:      0.833
Method:                         Least Squares   F-statistic:       99.53
Date:                Fri, 13 Jun 2025   Prob (F-statistic):  5.51e-36
Time:                  20:41:08         Log-Likelihood:     693.58
No. Observations:          100   AIC:                 -1375.
Df Residuals:              94   BIC:                 -1360.
Df Model:                   5
Covariance Type:            nonrobust
=====
```

	coef	std err	t	P> t	[0.025	0.975]
const	0.4448	0.051	8.729	0.000	0.344	0.546
velocity_X_DYNAMIC	5.0684	1.033	4.908	0.000	3.018	7.119
acceleration_X_DYNAMIC	-13.2190	1.494	-8.850	0.000	-16.185	-10.253
FORCE_S_DYNAMIC	1.549e-07	6.05e-07	0.256	0.798	-1.05e-06	1.36e-06
Damping_ratio_DYNAMIC	-0.0058	0.014	-0.405	0.687	-0.034	0.023
Structural_Behavior_Coefficient	-0.0005	7.08e-05	-6.887	0.000	-0.001	-0.000

```
=====
Omnibus:                 3.044   Durbin-Watson:        1.722
Prob(Omnibus):           0.218   Jarque-Bera (JB):    2.650
Skew:                    -0.200   Prob(JB):             0.266
Kurtosis:                 3.690   Cond. No.          3.85e+07
=====
```

Markov Transition Matrix Visualization





Fragility Curves

