# EVALUATION OF RESIDUAL AXIAL LOAD-CARRYING CAPACITY OF RC COLUMNS AFTER SHEAR FAILURE

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## 1. INTRODUCTION

From the post-earthquake reconnaissance survey, it is observed that reinforced concrete (RC) short columns and RC columns with poor transverse reinforcement are vulnerable to shear failure. For severely shear-damaged RC columns without adjacent load redistribution members around them, the deterioration of the axial load carrying capacity of these damaged columns can lead to a partial or global building collapse. It can cause a great loss of lives and property. Therefore, it is necessary to evaluate the residual axial load-carrying capacity of them.

Until now, several evaluation models [1]-[3] have been proposed by other researchers to account for the loss of axial load-carrying capacity for such RC columns prone to shear failure. However, it is not easy to obtain an intuitive understanding regarding the loss of axial load carrying capacity through these models.

Hence, in this paper, an arch resistance model is proposed for shear damaged RC columns, which can give a better understanding of the loss of axial load-carrying capacity.

## 2. ARCH RESISTANT MODEL

In this paper, the state of shear force equal to 0 is defined as the limit state of axial collapse. The model of shear-damaged RC columns can be established as Figure 1. The equilibrium equation of moment of it is shown in Equation 1.

It should be noted that in this model the axial forces acting with an eccentricity *e* at the end sections of confined concrete part can develop a force couple, which resists the moment induced by the *P-Δ* effect of longitudinal steel bars. The resistance of the force couple ($N_C e$) acting on the crushed concrete can be considered as the interaction between crushed concrete and longitudinal steel bars and it is called 'arch effect' in this research. It is the big difference compared with other models proposed in the past studies.

Based on the theory of structural mechanics, the evaluation formula of the residual axial load-carrying capacity of shear-damaged RC columns can be deduced.

## 3. APPLICATION OF THE ARCH RESISTANCE MODEL

To verify the accuracy of the evaluation formula of residual axial load-carrying capacity, a database of test results is compiled from the previous studies. The application results of the shear-friction model [2] and the arch resistant model with the same database are shown in Figure 2. It shows that the arch resistant model can give a better estimate than the shear-friction model for most of specimens.

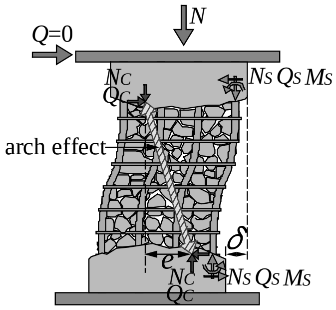
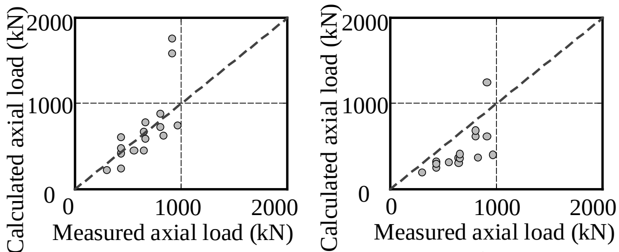



Figure 1 Model of shear-damaged RC columns

$$nN_S\delta = 2nM_S + N_C e \quad (1)$$




(a) Arch resistance model (b) Shear-friction model

Figure 2 Comparison of calculated-to-measured results

## 4. CONCLUSIONS

For RC columns damaged in shear, the arch resistance model to predict residual axial load-carrying capacity is proposed. For most of the specimens included in the compiled database, the calculated residual axial load-carrying capacity through the arch resistance model has a good agreement with the measured result. Its high accuracy is confirmed by comparing with the application result of the shear-friction model with the same database.

## REFERENCES

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