

## Background and Objective

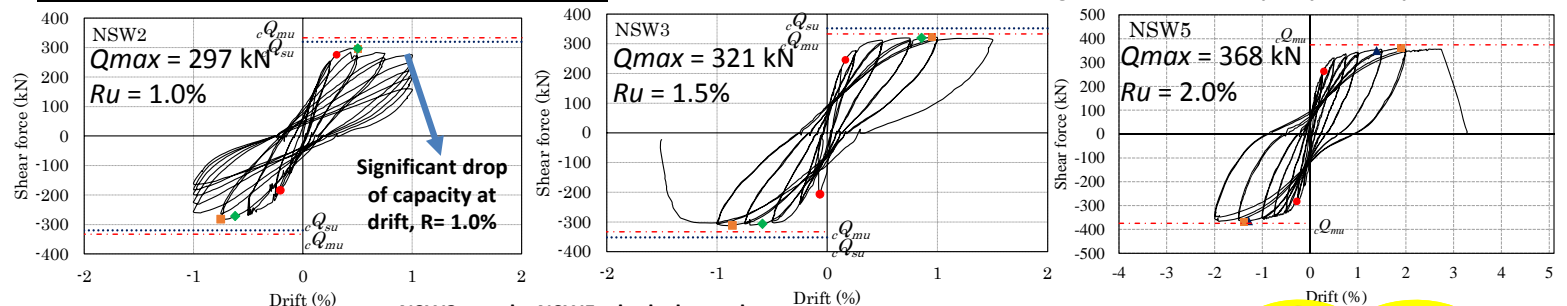
Many perimeter lightly reinforced concrete (RC) walls with opening (spandrel, wall pier, wing wall) had shear failure during the 2011 Tohoku Earthquake. Due to large opening, they cannot be treated as structural member [AIJ 1999] and their capacity are not necessarily considered in a practical structural calculation. These kind of walls usually have a single curtain of distributed reinforcement, lack of hooks, and without confinement at boundary regions. In this study, the effects of shear reinforcement, hooks, and boundary regions confinement on seismic behavior of lightly RC walls were investigated.

## Specimen Details

NSW2 is a prototype wall specimen to simulate shear type damage of lightly RC walls observed in the 2011 Tohoku Earthquake. It had horizontal web reinforcement ratio,  $\rho_{wh}$  of 0.25%. NSW3 and NSW5 had upgraded reinforcement details to increase shear capacity and flexural ductility. NSW3 and NSW5 had  $\rho_{wh}$  of 0.5% and 1.0%, respectively. Horizontal reinforcement of NSW3 and NSW5 had 180 degree hooks at its both ends. In addition, D6@60 closed hoops at boundary regions were provided as confinement for NSW5.

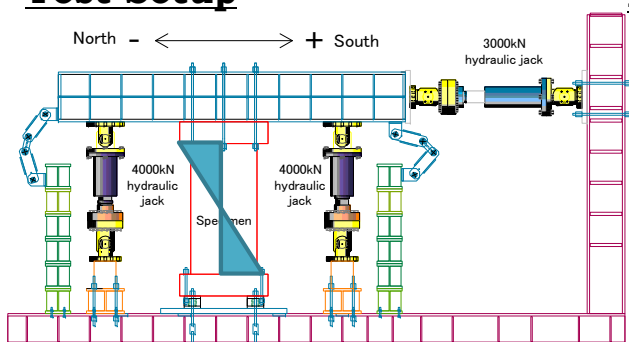


## Shear Force - Drift Relations

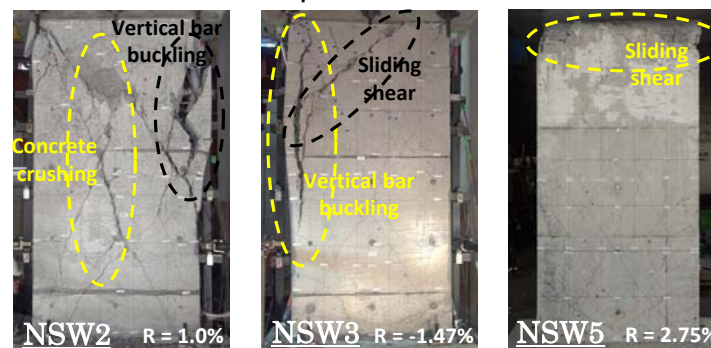


NSW2 failed due to shear, while NSW3 and NSW5 failed due to sliding shear. NSW3 and NSW5 had higher ultimate drift capacity,  $R_u$  compared to NSW2.

## Test Setup



## Final Damage



NSW3 and NSW5 had less damage compared to NSW2 at the same drift level.

## Conclusion

Increasing the amount of horizontal reinforcement prevented the opening of shear cracks. In addition, providing confinement at boundary regions prevented buckling of vertical reinforcement and made wall more ductile. However, sliding shear still occurred at NSW5 due to less of vertical web reinforcement.

