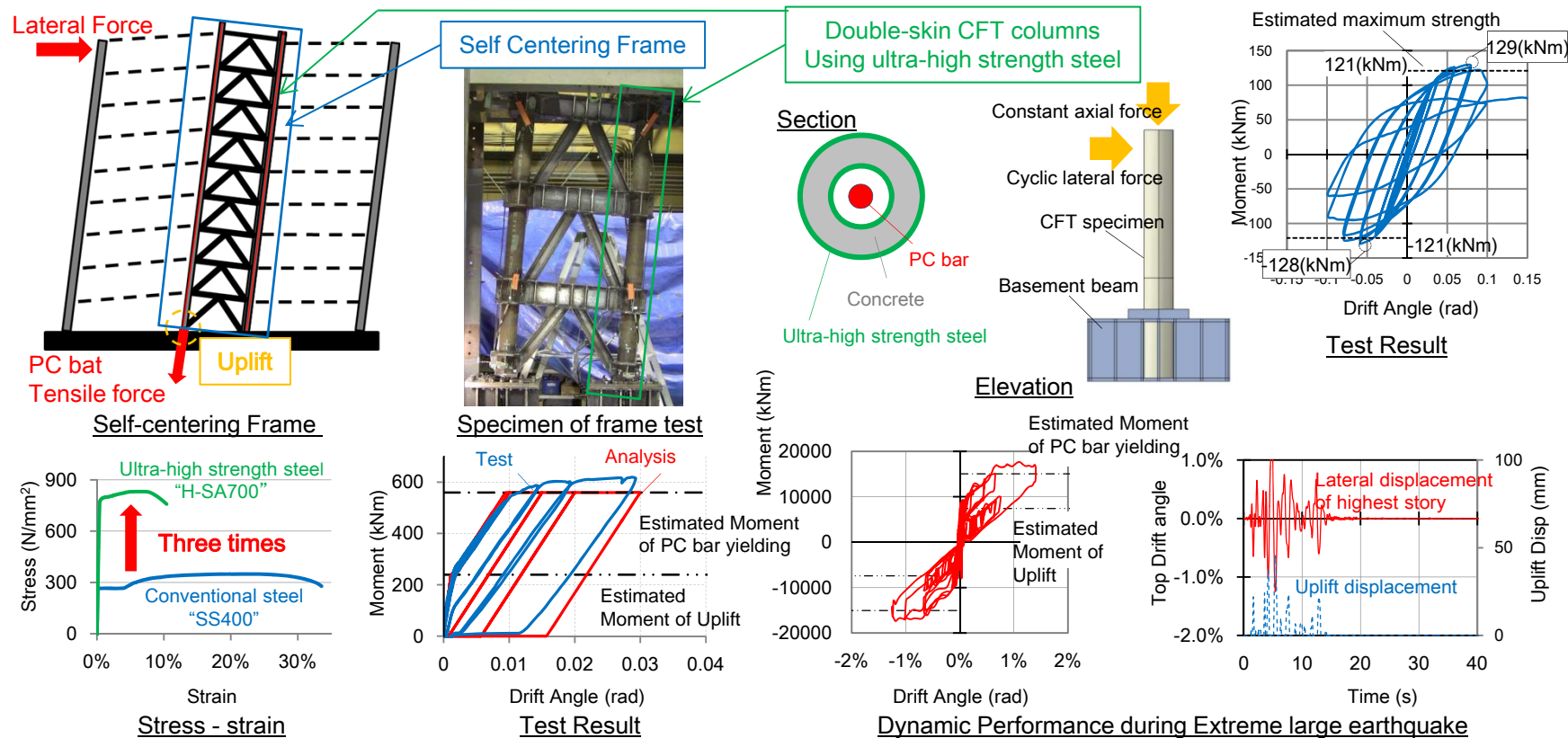# Self Centering Frame with Rocking using CFT Columns made of high strength steel

Background : Reducing residual deformation is substantial for buildings to achieve continuing business and prompt recovery after earthquakes. A self-centering frame system with rocking using CFT columns was developed. The proposed frame system effectively reduce the residual deformations of the frame through the restoring forces applied by the PC bars installed in the columns. Double-skinned CFT columns using ultra-high strength steel greatly enlarge the strength and elastic deformation capacities of the columns.

Methodology : 1) A series of double-skinned CFT columns using H-SA700 steel were tested through combined axial and flexural cyclic loadings to evaluate the seismic behavior of the columns. 2)Tests of a three story frame specimen were conducted to examine the cyclic behavior of the proposed self-centering system. 3) Numerical models of the proposed system were established to extend the experimental findings and achieve comprehensively seismic performance evaluation pf the self-centering system.

Lateral Force

Self Centering Frame

Double-skin CFT columns Using ultra-high strength steel

PC bat Tensile force

Uplift

Self-centering Frame

Specimen of frame test

Section

PC bar
Concrete
Ultra-high strength steel

Constant axial force
Cyclic lateral force
CFT specimen
Basement beam

Elevation

Estimated maximum strength
129(kNm)
121(kNm)
128(kNm)
121(kNm)

Test Result

Stress - strain

Ultra-high strength steel "H-SA700"

Three times

Conventional steel "SS400"

Test   Analysis

Estimated Moment of PC bar yielding

Estimated Moment of Uplift

Test Result

Estimated Moment of PC bar yielding

Estimated Moment of Uplift

Lateral displacement of highest story

Uplift displacement

Dynamic Performance during Extreme large earthquake

Conclusion: The double-skinned CFT columns using ultra-high strength steel provide efficiently large strength and elastic deformation capacity which are sufficient for the use in the self-centering frame. The developed numerical models of the self-centering system were validated by the results of the three story frame test. Nonlinear dynamic analysis verified that this self-centering system enable to achieve no residual deformation after extremely large earthquakes.