New Approach of Modeling and Seismic Assessment of Transfer-plate High-rise Building Structures

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Abstract: This research is aimed at fulfilling an existing knowledge gap with the seismic assessment of transfer-plate structural systems in support of high-rise buildings (TPHRB). An innovative approach of structural modeling with the ultimate goal of achieving a reliable, robust and transparent seismic design methodology is under development. The shear concentration at the external shear wall and the rotational demand of the coupling beams in the upper zone of the building, together with an improved estimate of the inter-storey drift demand (by incorporating various localized and global phenomena) are being studied in detail.

Transfer-plate High-rise Buildings

Governed primarily by the architectural and functional requirements, *transfer-plate structural system* is often encountered in the design and vulnerability assessment of reinforced-concrete high-rise buildings. It is more so in the modern and densely populated cities in various parts of the world. The transfer plate is generally designed to transfer loads from the *upper zone,* comprising of *coupled shear walls* (which typically houses businesses or apartments), down to the *lower zone,* comprising of *moment resisting frames* having large-sized and largely-spaced columns often referred to as "*mega columns*". The lower zone typically houses the facilities such as parking, restaurants, supermarket, assembly hall, podium etc. The system is illustrated in **Fig. 1**.

Problem Statement/Objectives and Methods

Over a decade or so now, different researchers have made investigations on the seismic behaviour of *transfer-plate high-rise building* (*TPHRB*) systems. They accomplished this by using shaking table tests or numerical methods or … both. However, the studies happened to be primarily *force-based*; and therefore, the emerging and more rational design philosophies such as *Displacement Based Design* and *Kinematic Based Design* are not considered. Moreover, after a recently identified issue of *in-plane deformation* of the 'thick' transfer plate, a new approach of *modelling* of the TPHRB structures has become necessary, while not making the model too complex or expensive from an *engineering* perspective. This research is thus aimed at fulfilling the mentioned knowledge gap, with the ultimate goal of achieving a *methodology* and tool for *reliable seismic assessment* and *design* of TPHRB systems. The methodology shall incorporate the various *localized* and *global* phenomena such as in-plane deformation of the transfer plate, *higher mode* effect, more accurate modelling of *plastic hinge* at the base of the mega columns, *torsional coupling*, *displacement controlled behaviour* (especially when the structure is located in *soft soil* site in the region of *low to moderate seismicity*), *foundation-structure interaction* etc. , having been highlighted in **Fig. 2**.

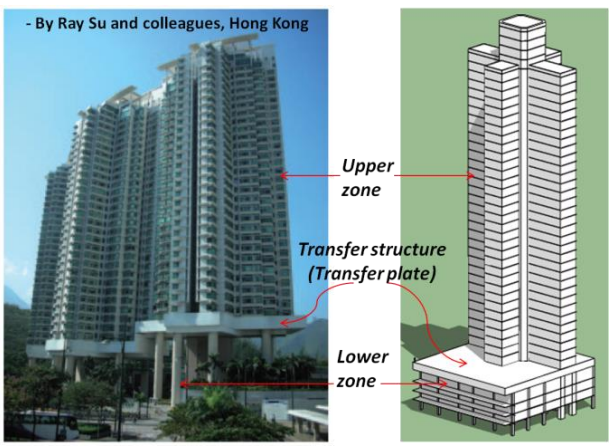

Fig. 1: Transfer-plate high-rise building (TPHRB)

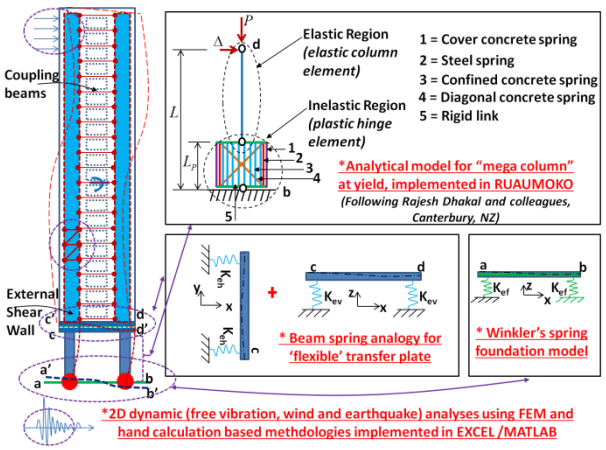

Fig. 2: New approach to modelling a TPHRB