A CASE OF STRUCTURAL DESIGN IN WHICH VISCOUS DAMPERS ARE USED TO ENHANCE EARTHQUAKE RESISTING PERFORMANCE OF A BUILDING

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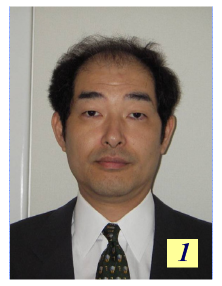


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1. INTRODUCTION

This paper introduces a high-rise office building in which attenuation type viscous dampers are intensively provided on the fist basement designed as the soft first story (intensive vibration control on the first basement).

Fig. 1: Appearance of building

2. OUTLINE OF BUILDING

Building name: Osaka Bar Association Building
Address : Kita-ku, Osaka City, Osaka Pref., Japan
Number of floors: 14 floors above the ground, 2 floors below the ground
Total floor area: 17037m^2 Building height:GL+55.25m
Major applications : Offices and conference rooms
Design and supervision: NIKKEN SEKKEI LTD.
Structure type: 1st basement and above: Steel structure (CFT in columns partially)
2nd basement: Steel-reinforced concrete structure
Major steel type: SN490B, STKN490B, LY225 and Cast steel pipes equivalent to SA440

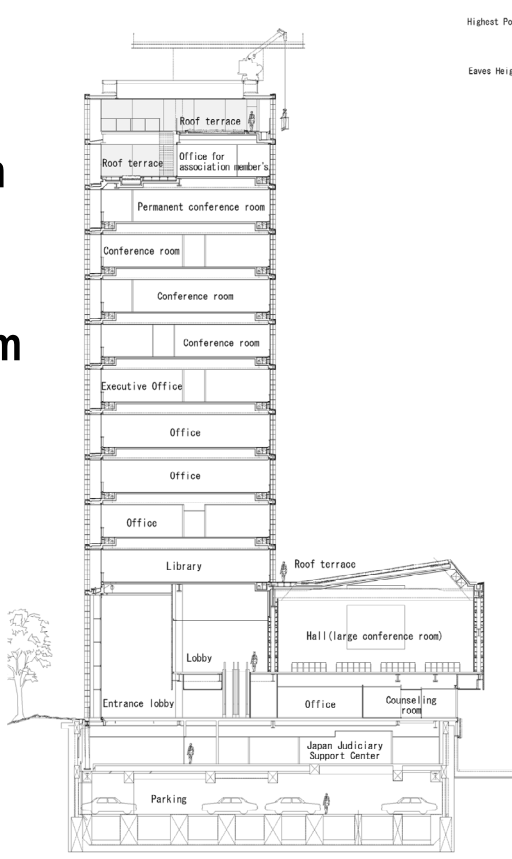

Fig. 3: Sectional plan

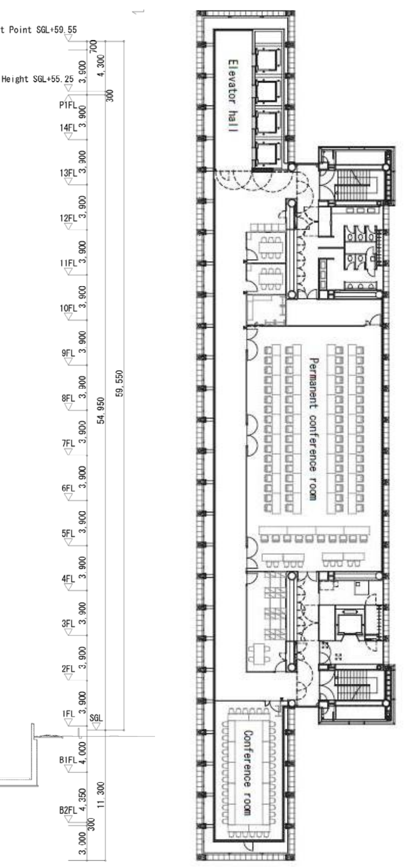

Fig. 4: Floor plan of 12th floor

3. STRUCTURE PLAN

The following two points are important issues in the structure plan.
1) Achieving the facade consistent with the construction plan and assuring high earthquake resistance. 2)Utilizing the existing underground structure .

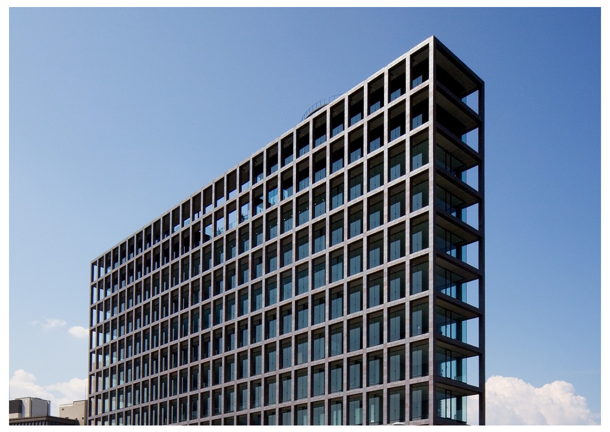

Fig. 5: Façade on south side

Fig. 6: Oil dampers intensively provided on vibration control story

4. ADOPTION OF SOFT FIRST STORY

By providing steel dampers and oil dampers intensively on the 1st basement which can offer large elastic deformation during earthquake, much earthquake energy can be consumed dynamically on the lowest story, and damages in the structure on upper stories during earthquake can be reduced.

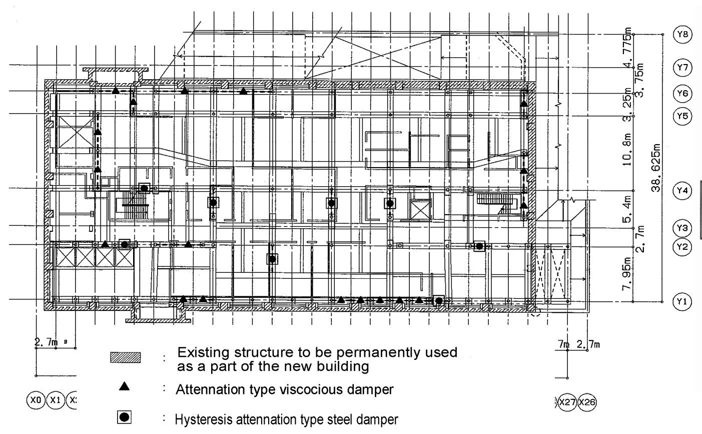

Fig. 11: Floor plan of Vibration control story (B1F)

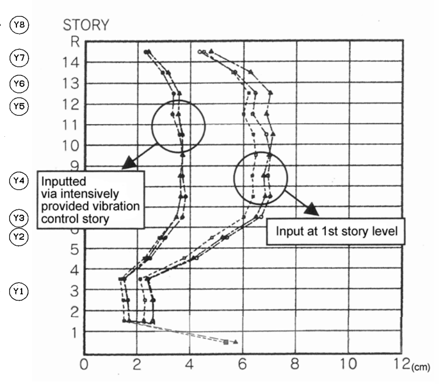

Fig.12: Vibration control effect indicated by inter-story displacement

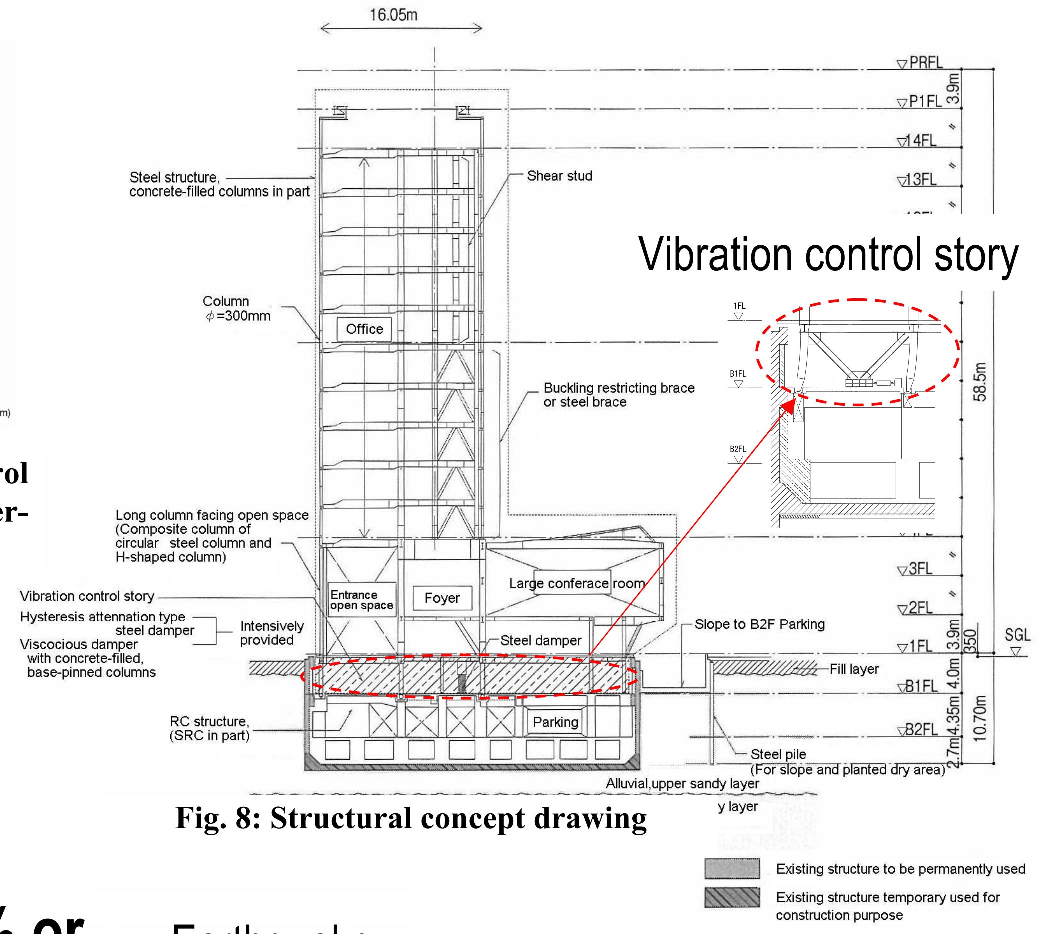

Fig. 8: Structural concept drawing

5. REDUCTION OF EARTHQUAKE LOADS APPLIED ON OUTER CIRCUMFERENCE FRAME

The earthquake-resisting core receives 70% or more of the story shear force to assure sufficient earthquake resistance even if the outer circumference frame becomes slender.

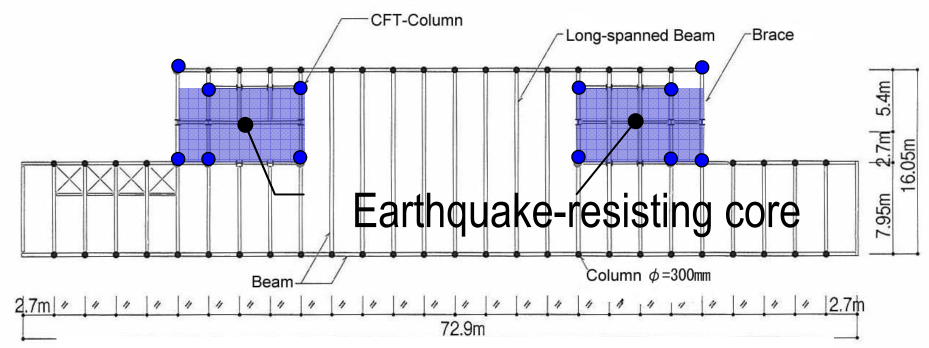

Fig. 14: Typical floor framing plan

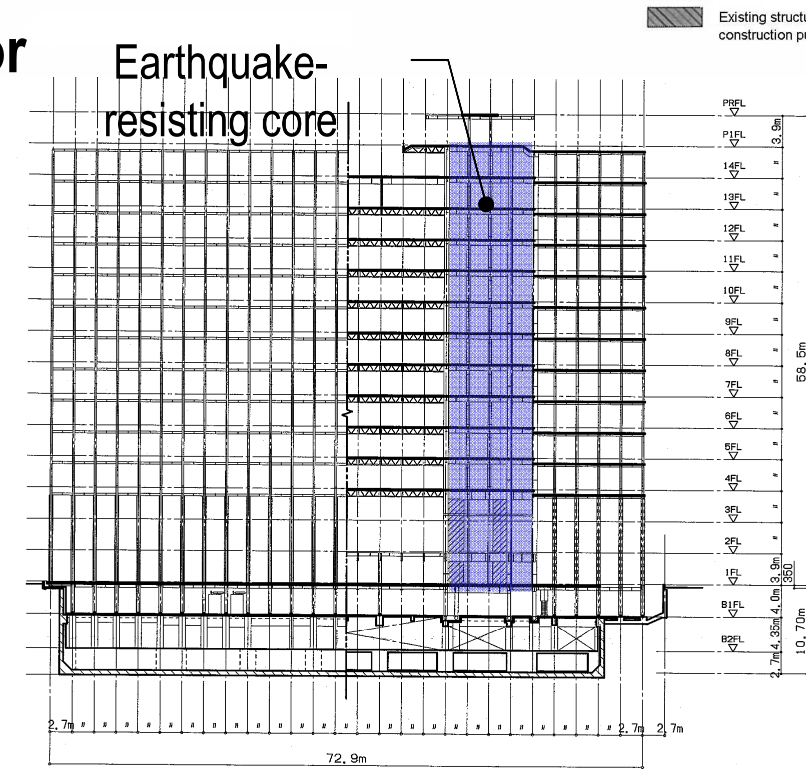

Fig. 15: Framing elevation in long side direction

6. CONCLUSION

This paper introduces a practical case of “intensive vibration control structure on the first story” as a “technique to absorb the energy efficiently and securely".