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ProtaStructure Design Guide

Seismic Separation Design (ASCE 7-16)

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Introduction

ProtaStructure determines the seismic separation condition according to **ASCE 7-16 Clause 12.12.3**. In this document, calculation details about seismic separation conditions are explained.

Building Model Details

The current document investigates the seismic separation condition of two models that belong to the exact property.
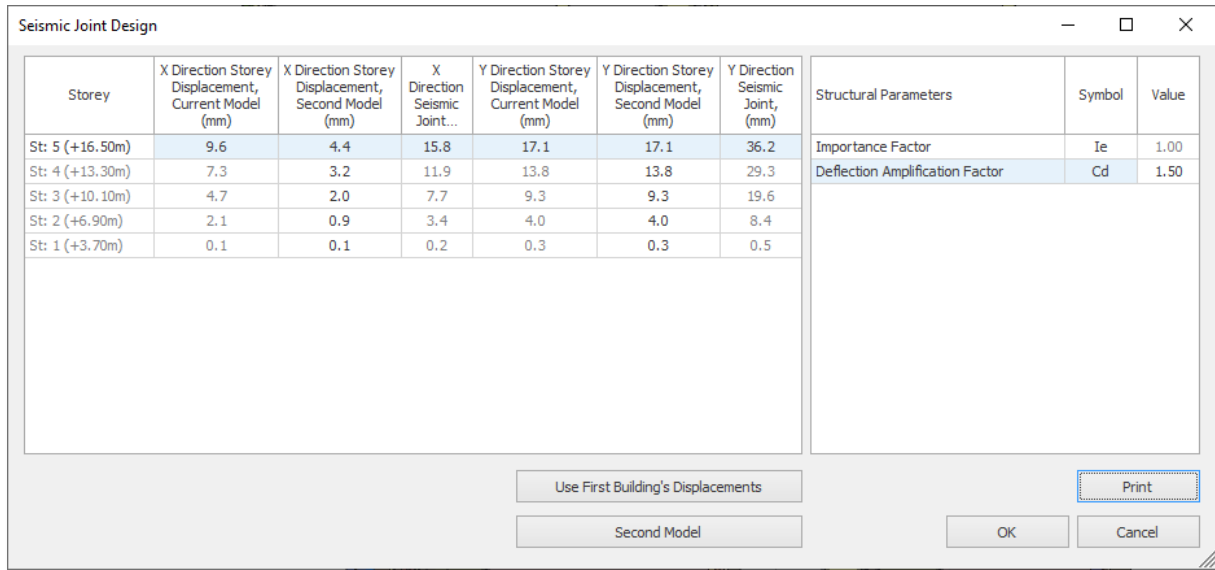
Block A consists of 6 stories, including the elevator maintenance floor. **Block B** consists of 5 stories.

Seismic separation aligns between X Direction for both buildings.
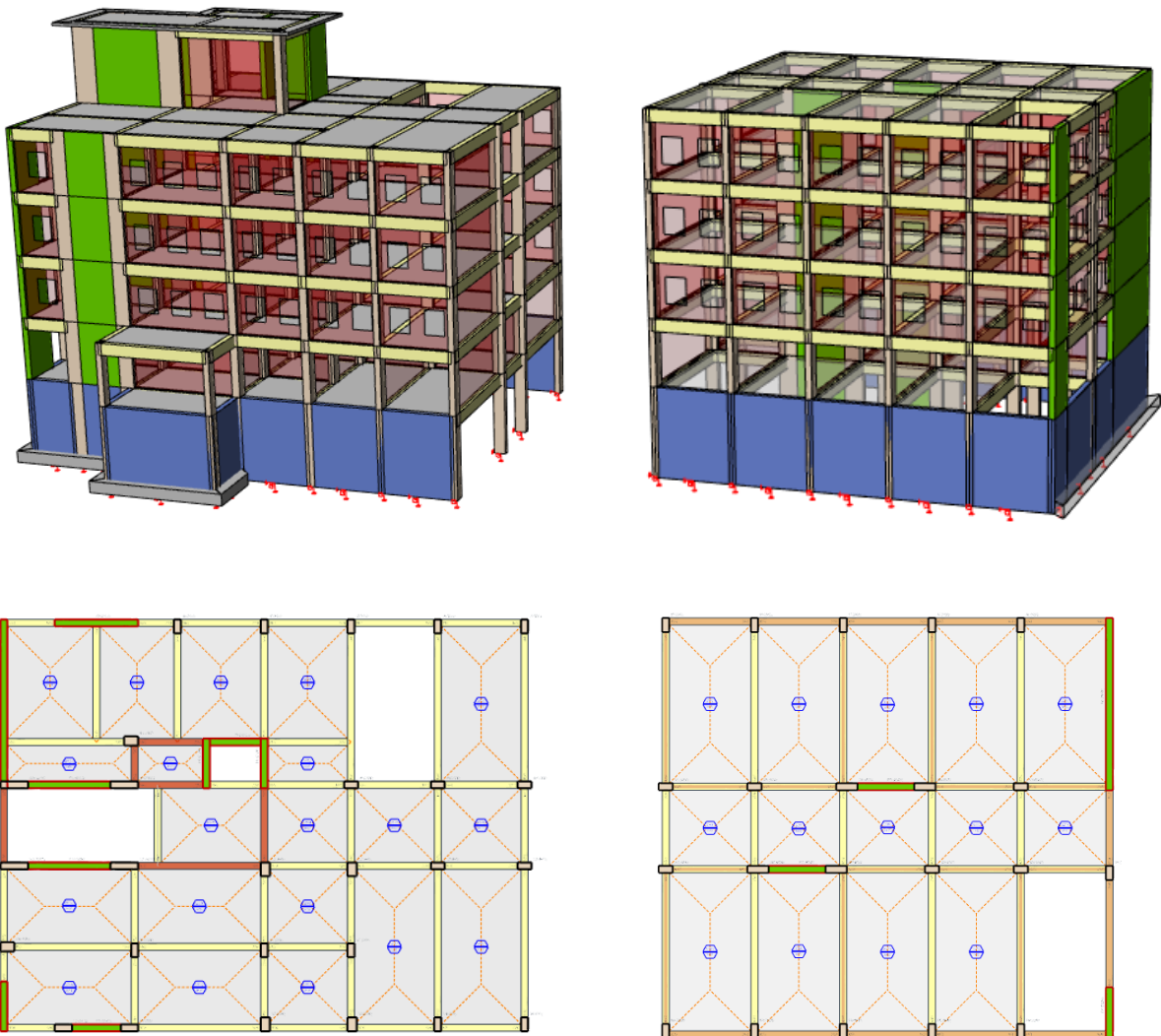
*3D and Typical Plan View of Building Models (A and B Block Accordingly)*

User Interface

At the "**Seismic Joint Design**" user interface, story displacements for the current model in both directions will be listed automatically. Users may set the second model story displacements manually or use the "**Second Model**" option to get story displacements from another model. Moreover, the **Deflection Amplification Factor, Cd**, can be set from the structural information table on the right side of the user interface.

In case **Use First Building's Displacements** button is used, current model story displacements will be set to second model story displacements.

If the "Second Model" option is used, the window given above will pop up. If there is no problem with the seismic analysis of the selected second model, story displacements for both directions will be saved. Users may set the seismic separation alignment by using the options given in the "**Seismic Joint Alignment**" box. The statement about the alignment given below the box will be updated accordingly.

If the number of stories of the second model is greater than the current model, story displacements will be used up to the number of current model stories. For the opposite case, missing stories will be used as zero.
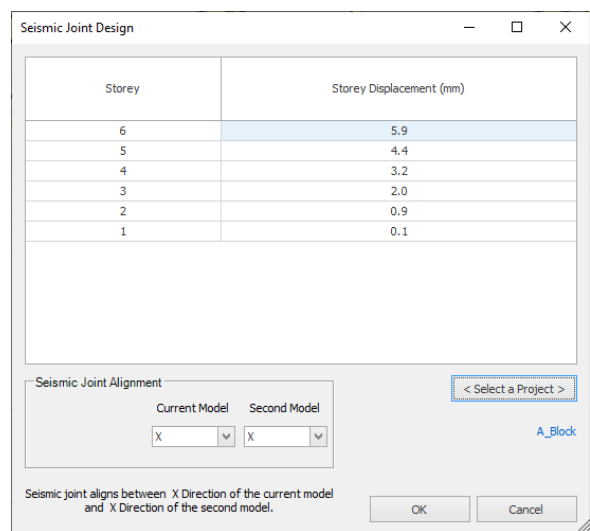
Calculation Details

ASCE 7-16 12.12.3 states, "Separations shall allow maximum inelastic response displacement (δ_M). δ_M shall be determined at critical locations with consideration for translational and torsional displacements of the structure, including torsional amplifications, where applicable, using the following equation:".

$$\delta_M = \frac{C_d \; \delta_{max}}{I_e}$$

δ_{max} is the maximum elastic displacement at the critical location.

According to **ASCE 7-16 12.12.3**, "Adjacent structures on the same property shall be separated by at least δ_{MT}, determined as follows."

$$\delta_{MT} = \sqrt{{\delta_{M1}}^2 + {\delta_{M2}}^2}$$

δ_{M1} and δ_{M2} = maximum inelastic response displacements of the adjacent structures at their edges.

Structural Parameters	Symbol	Value
Importance Factor	I_e	1
Deflection Amplification Factor	C_d	1.5

St. No	Z (m)	Maximum Elastic Displacement of Current Model (mm)	Maximum Elastic Displacement of Second Model (mm)	Seismic separation (mm)
St: 5 (+16.50m)	16.5	9.6	4.4	15.8
St: 4 (+13.30m)	13.3	7.3	3.2	11.9
St: 3 (+10.10m)	10.1	4.7	2	7.7
St: 2 (+6.90m)	6.9	2.1	0.9	3.5
St: 1 (+3.70m)	3.7	0.1	0.1	0.2

According to **ASCE 7-16 12.12.3,** seismic separation should not be less than **15.8 mm.**

Suggested Seismic Separation: **20 mm**

Summary

This document explains the calculation details of seismic separation conditions according to ASCE 7-16 12.12.3. The "Seismic Joint Design" macro results are verified with hand calculations.

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