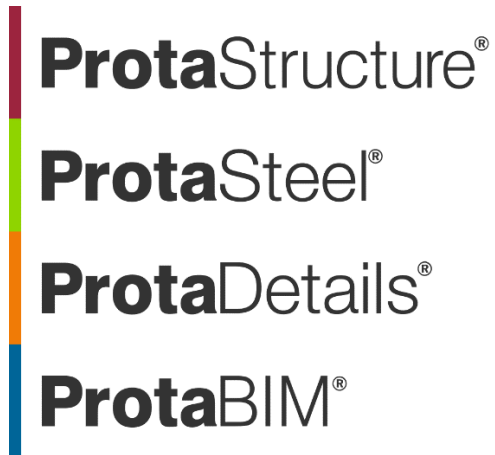




ProtaStructure Design Guide

Seismic Separation Design (ASCE 7-16)

Version 3.0

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Introduction

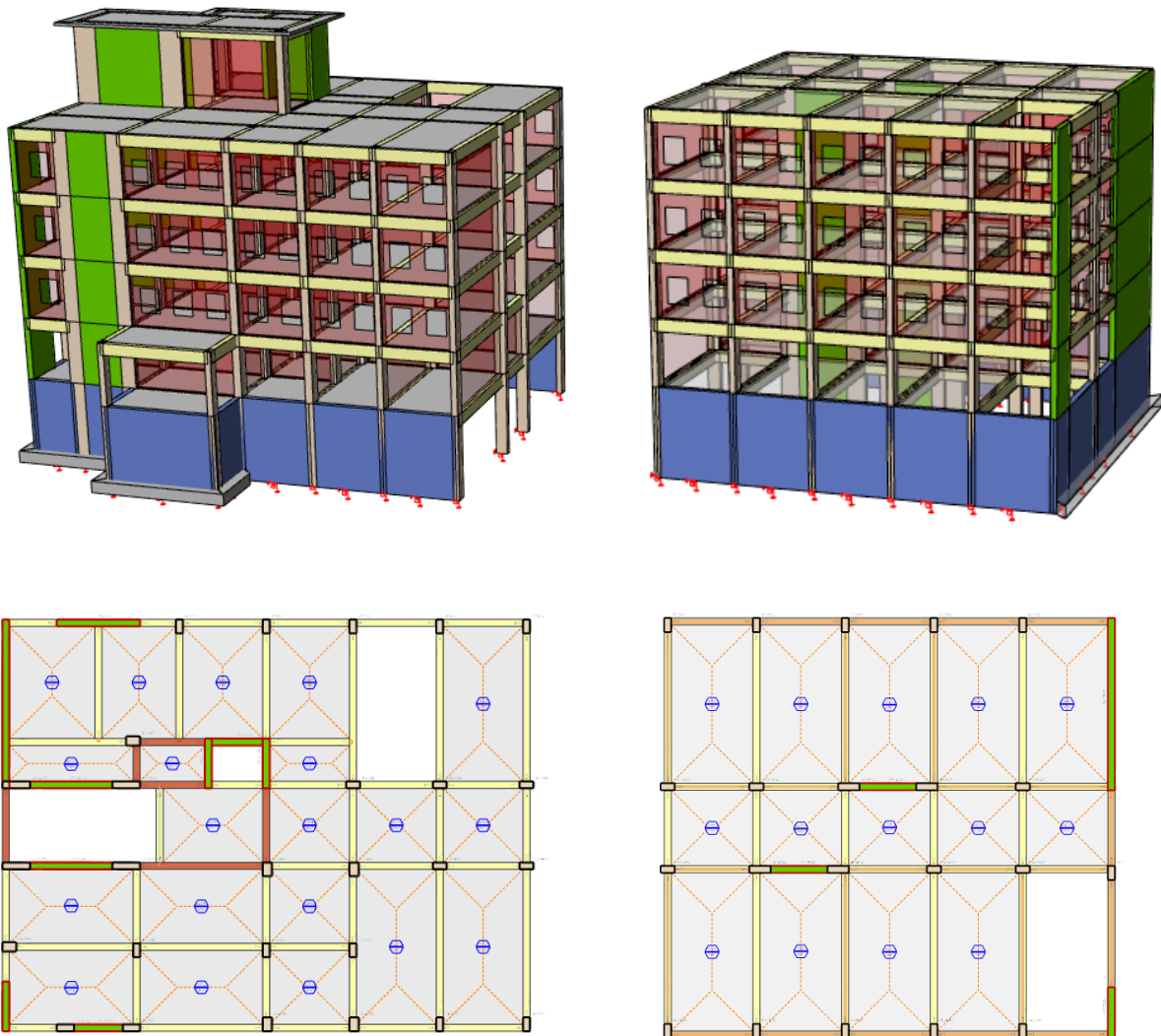
ProtaStructure determines the seismic separation condition according to **ASCE 7-16 Clause 12.12.3**. In this document, calculation details about seismic separation conditions are explained.

Building Model Details

The current document investigates the seismic separation condition of two models that belong to the exact property.

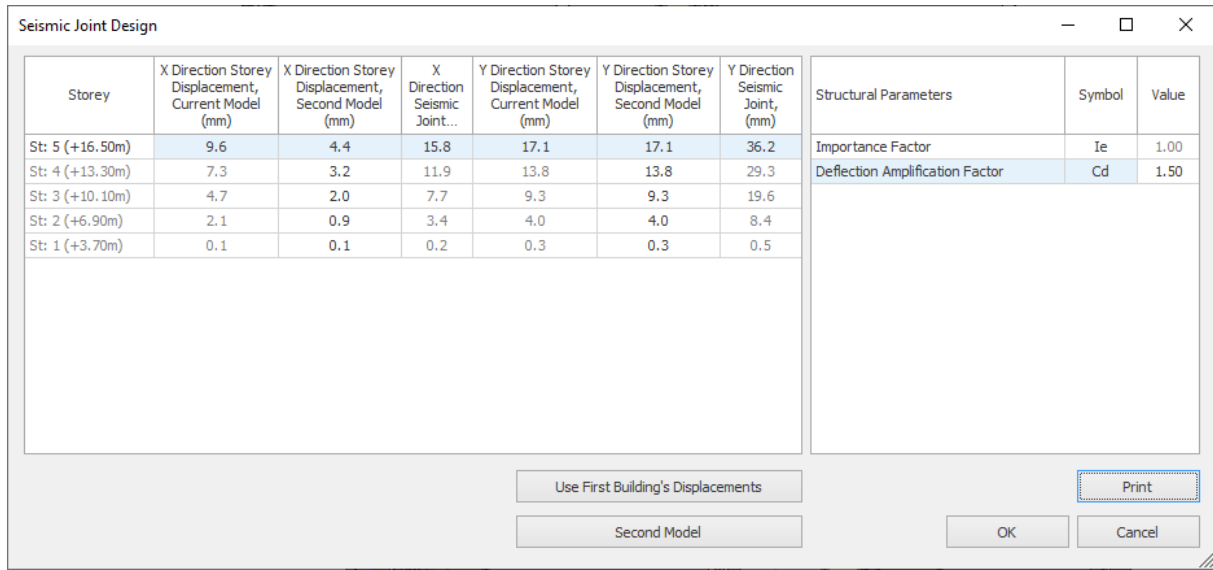
Block A consists of 6 stories, including the elevator maintenance floor. **Block B** consists of 5 stories.

Seismic separation aligns between X Direction for both buildings.



3D and Typical Plan View of Building Models (A and B Block Accordingly)

User Interface



The screenshot shows the 'Seismic Joint Design' window. It features a table with columns for Storey, X Direction Storey Displacement (Current Model), X Direction Storey Displacement (Second Model), X Direction Seismic Joint..., Y Direction Storey Displacement (Current Model), Y Direction Storey Displacement (Second Model), and Y Direction Seismic Joint... The table lists data for five storeys (St: 5 to St: 1). To the right, there is a 'Structural Parameters' table with columns for Symbol and Value, showing 'Importance Factor' (Ie, 1.00) and 'Deflection Amplification Factor' (Cd, 1.50). At the bottom, there are buttons for 'Use First Building's Displacements', 'Second Model', 'Print', 'OK', and 'Cancel'.

Storey	X Direction Storey Displacement, Current Model (mm)	X Direction Storey Displacement, Second Model (mm)	X Direction Seismic Joint...	Y Direction Storey Displacement, Current Model (mm)	Y Direction Storey Displacement, Second Model (mm)	Y Direction Seismic Joint, (mm)
St: 5 (+16.50m)	9.6	4.4	15.8	17.1	17.1	36.2
St: 4 (+13.30m)	7.3	3.2	11.9	13.8	13.8	29.3
St: 3 (+10.10m)	4.7	2.0	7.7	9.3	9.3	19.6
St: 2 (+6.90m)	2.1	0.9	3.4	4.0	4.0	8.4
St: 1 (+3.70m)	0.1	0.1	0.2	0.3	0.3	0.5

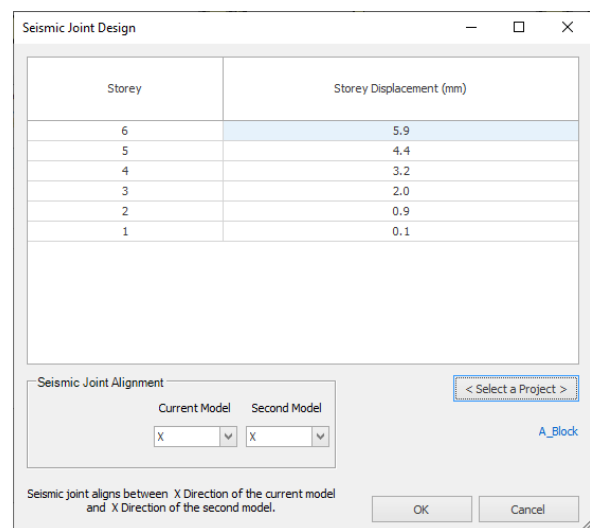
Structural Parameters	Symbol	Value
Importance Factor	Ie	1.00
Deflection Amplification Factor	Cd	1.50

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.



The screenshot shows the 'Seismic Joint Design' window with the 'Seismic Joint Alignment' sub-window open. The sub-window has a table with columns for Storey and Storey Displacement (mm), listing data for six storeys (6 to 1). Below the table, there are dropdown menus for 'Current Model' and 'Second Model', both set to 'X'. A button labeled '< Select a Project >' is visible. At the bottom, there is a text box stating 'Seismic joint aligns between X Direction of the current model and X Direction of the second model.' and buttons for 'OK' and 'Cancel'.

Storey	Storey Displacement (mm)
6	5.9
5	4.4
4	3.2
3	2.0
2	0.9
1	0.1

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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