



# Universidad de los Andes



SFM4/LR/LD

UCL

1 of 4

High (HD)

Both (HV)

3-D Element-by-Element

0.9

0.0D+0.25L

0.9

Date Building Type:

Authors:

Sheet

High (HR)

Medium (MD)

Vertical (VI)

SFM4/LR(1)/LD/FD/NI/LP/LO/RF/NP/OS/GC/VN

Steel Framed Building with Masonry Wall (SFM4)

Х

Х

Х

Х

Х

Medium (MR)

Horizontal (HI)

Low (LD)

Rigid (RD)

Long (LP)

Large (LO)

Rigid (RF)

Yes (PR)

Good (GC)

Retrofitted (RS)

Non Vulnerable (NN)

# FRAGILITY/VULNERABILITY ASSESSMENT

### STEEL FRAMED MASONRY WITH RECTANGULAR BLOCKS IN CEMENT MORTAR INDEX BUILDING

### GENERAL INFORMATION

### Index Building Taxonomy String: 1. Main structural system:..... 2. Height range:.... Low (LR) Х 3. Seismic design level:.... Poor (PD) 4. Diaphragm Type:.... Flexible (FD) Х 5. Structural Irregularity:.... No (NI) Х 6. Wall Panel Length: Short (SP) Small (SO) 7. Wall Openings: 8. Foundation Type and Flexibility:..... Flexible (FF) No (NP) 9. Seismic Pounding Risk: Х 10. Seismic Retrofitting: Original (OS) Х 11. Structural Health Condition:..... Poor (PC) Vulnerable (VN) X 12. Non-Structural Components:.....

### INTRINSIC CHARACTERISTICS

General Geometry:	
Building Plan Area (m <sup>2</sup> ):	58
Building Total Floor Area (m <sup>2</sup> ):	58
Number of Stories:	1
Story Height (m):	2.1
Number of Spans in X Direction:	2
Typical Span Length in X Direction (m):	6.5
Number of Spans in Y Direction (m):	1
Typical Span Length in Y Direction (m):	4.3
Wall Thickness (mm):	250
Wall Construction:	English Bond
Thickness	One Brick

### MODELLING PARAMETERS

**Modelling Consideration** 

Analysis Considerations:

Loads:

Numerical Model Type:....

Roof Dead Load (D) (kN/m2):....

Design Live Load (L) (kN/m<sup>2</sup>):....

Load Combination for Seismic Analysis:..... Average Load per Square Meter (kN/m<sup>2</sup>):....



Masonry Modelling Approach:..... Simplified Micro-Modelling

### Material Properties of Masonry:

Unit Weight, γ (kg/m <sup>2</sup> ):	1920
Modulus of Elasticity, E (MPa):	263
Shear Modulus, G (MPa):	158
Compressive Strength, f'm (MPa):	4.14
Cohesion, c (MPa):	0.069
Tensile Strength, ft (MPa):	0.069
Friction Coefficient, µ:	0.6

### SEISMIC BEHAVIOR

Seismic Weight of IP Walls (kN):	•••
Fundamental Time Period of IP Walls (sec):	

250 0.13

### Pushover Curve with Damage State Thresholds:







## IB14 LBM SFM4 LR LD





GFDRR



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### STEEL FRAMED MASONRY WITH RECTANGULAR BLOCKS IN CEMENT MORTAR INDEX BUILDING

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IP Wall Behavior

OP Threshold: hairline cracks (black) of 0.35 mm maximum width appeared at some corners of opening.





Sheet:

**OP Threshold:** Minor cracks (black) appeared at the connection with the in-plane wall, with a maximum crack width of 1 mm.



**IO Threshold**: Minor cracks of maximum crack width of 2 mm extended to 1/3rd of the height downwards at the connection between IP walls. Minor shear cracks (black) also appeared in the IP wall portions as well.



LS Threshold: The left most pier has developed extensive shear crack because of reduced capacity due to OOP wall collapse. Major shear cracks as well as horizontal cracks appear through the most of piers. drift in the shear failing pier 0.5%. max crack width 12 mm. Horizontal crack opening in the pier is 1.3 mm.



LS Threshold: Major cracks (black) of maximum width 4 mm extended almost through full height of the IP wall connection, and shear cracks also developed through full pier width in the IP portion for the activation of U shaped combined mechanism. A minor horizontal crack (black) at the base with a maximum opening of 1.2 mm developed through full length of the wall.



**CP Threshold**: Left most pier has been damaged and fallen down, middle piers between door and window have developed extensive crack with width of more than 12.5 mm i.e. damaged in shear flexure, other piers are rocking in flexure without loosing strength.



**CP Threshold:** U shaped combined mechanism is fully formed with extensive crack width of 12 mm maximum crack width on the sides and the maximum opening at the horizontal base crack is 4 mm.

# IO Threshold: Hairline to minor cracks (black) developed at the corners of most of the openings, with a maximum of 2 the (black) developed at the corners of most of the openings, with a maximum of 2 the (black) developed at the corners of most of the openings, with a maximum of 2 the developed at the corners of most of the openings, with a maximum of 2 the developed at the corners of most of the openings, with a maximum of 2 the developed at the corners of most of the openings, with a maximum of 2 the developed at the corners of most of the openings, with a maximum of 2 the developed at the developed at the corners of most of the openings, with a maximum of 2 the developed at the openings, with a maximum of 2 the developed at t



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