

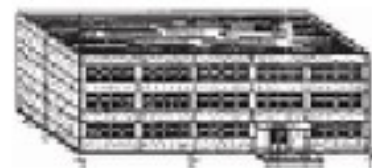
Masonry buildings

Reinforced buildings

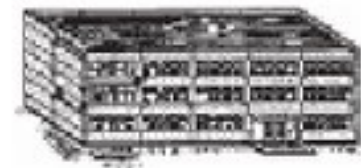
Classification of damages



Grade 1: Negligible to slight damage (no structural damage, slight non-structural damage)



Grade 2: Moderate damage (slight structural damage, moderate non-structural damage)








Grade 3: Substantial to heavy damage (moderate structural damage, heavy non-structural damage)



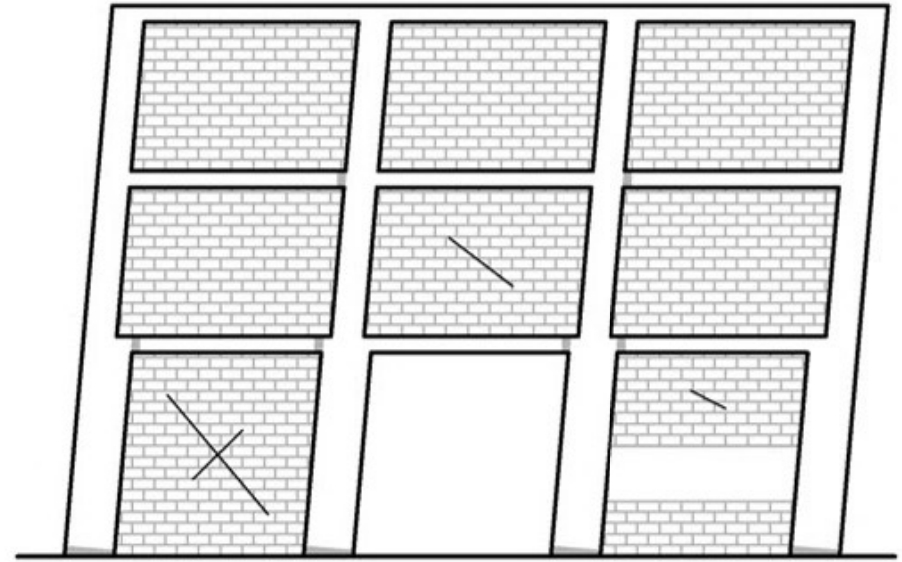
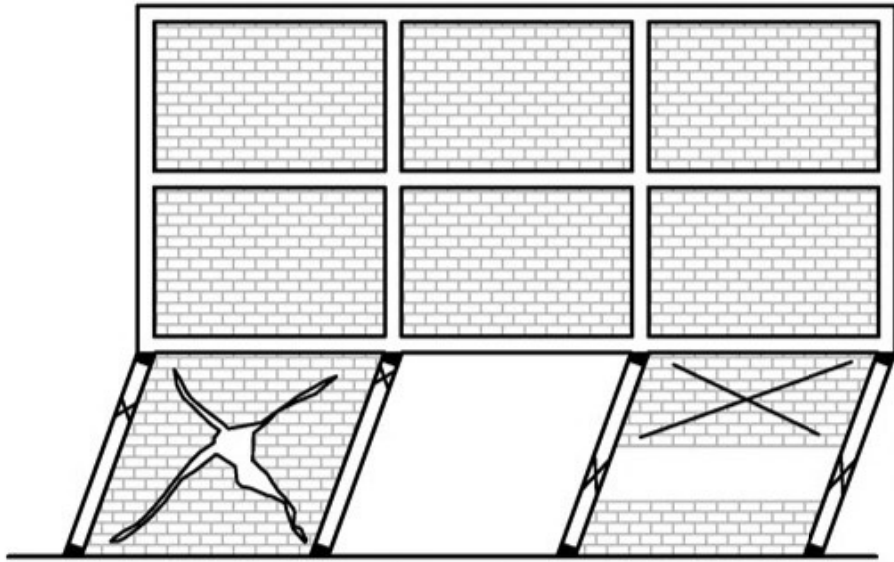
Grade 4: Very heavy damage (heavy structural damage, very heavy non-structural damage)



Grade 5: Destruction (very heavy structural damage)

| DS1 | DS2 | DS3 | DS4 | DS5 |
|---|---|---|---|---|
|  |  |  |  |  |
| <p>Grade 1: Negligible to slight damage (no structural damage, slight non-structural damage)</p> | <p>Grade 2: Moderate damage (slight structural damage, moderate non-structural damage)</p> | <p>Grade 3: Substantial to heavy damage (moderate structural damage, heavy non-structural damage)</p> | <p>Grade 4: Very heavy damage (heavy structural damage, very heavy non-structural damage)</p> | <p>Grade 5: Destruction (very heavy structural damage)</p> |
| <p><u>Fine cracks in plaster over frame members</u> or in walls at the base. <u>Fine cracks in partitions and infills</u></p> | <p><u>Cracks in columns and beams of frames</u> and in structural walls. <u>Cracks in partition and infill walls</u>; fall of brittle cladding and plaster. Falling mortar from the joints of wall panels</p> | <p><u>Cracks in columns and beam column joints</u> of frames at the base and at joints of coupled walls. <u>Spalling of concrete cover, buckling of reinforced rods.</u> <u>Large cracks in partition and infill walls, failure of individual infill panels</u></p> | <p><u>Large cracks in structural elements</u> with compression failure of concrete and fracture of rebars; bond failure of beam reinforced bars; tilting of columns. Collapse of a few columns or of a single upper floor</p> | <p>Collapse of ground floor or parts (e. g. wings) of buildings</p> |
| $\min(\Delta_{cr}^{inf}; \Delta_{cr}^{RC})$ | $\min(\Delta_{max}^{inf}; \Delta_y^{RC})$ | $\min \left(\begin{array}{l} \Delta_{ult}^{inf}; \Delta_{spalling}^{RC}; \\ \Delta_{buckling}^{RC} \end{array} \right)$ | Δ_{ult}^{RC} | Δ_{coll}^{RC} |

RENTABILIDAD: $\text{COSTE GLOBAL} = \text{CONSTRUCCIÓN} + \text{REFUERZO} + \text{HUMANO}$



NCSE-02

EC8

Seguridad

✓

Coste construcción

✗

Coste apuntalamiento y refuerzo

✓

Localización de refuerzo

✗

Riesgo estabilidad global

✓

Predictibilidad daños

✓

Coste desalojo

✓

Víctimas

✓

✗

✓

✗

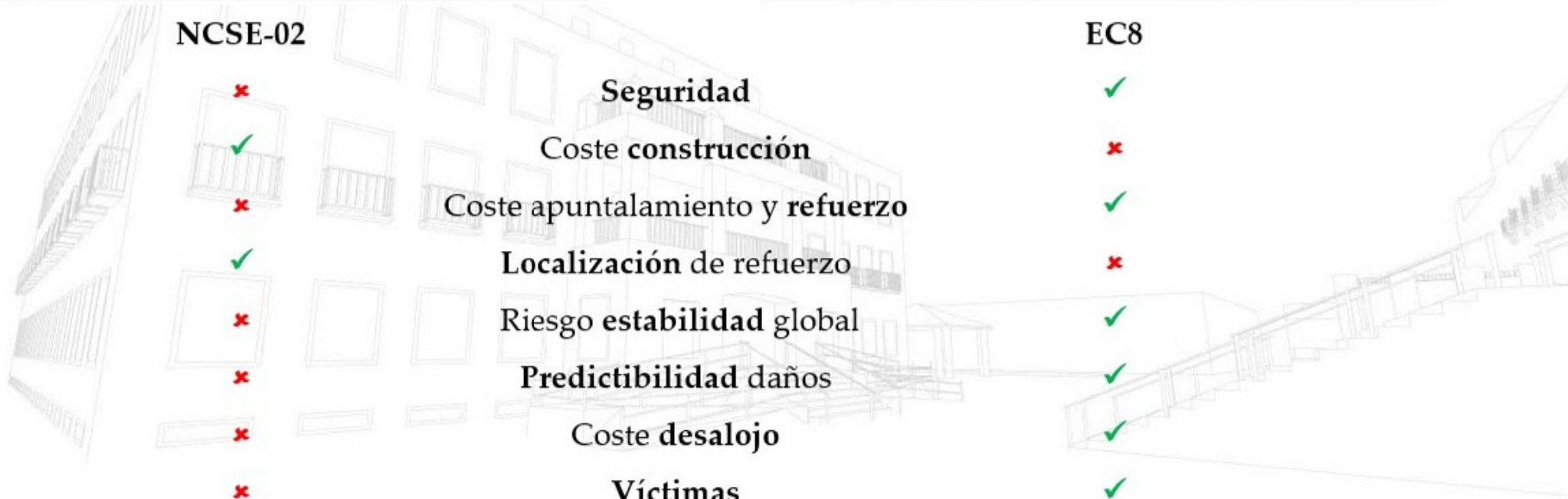
✓

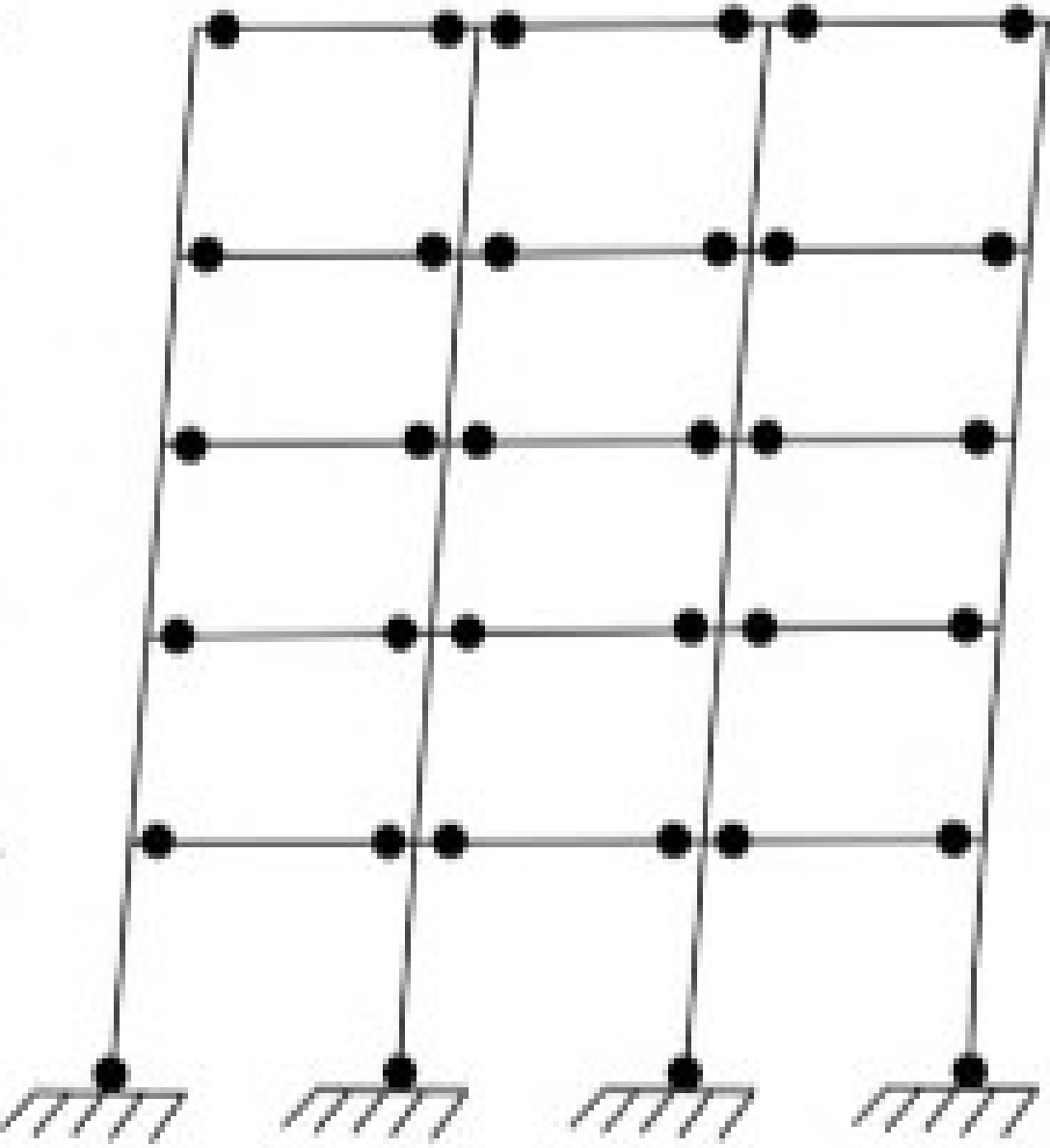
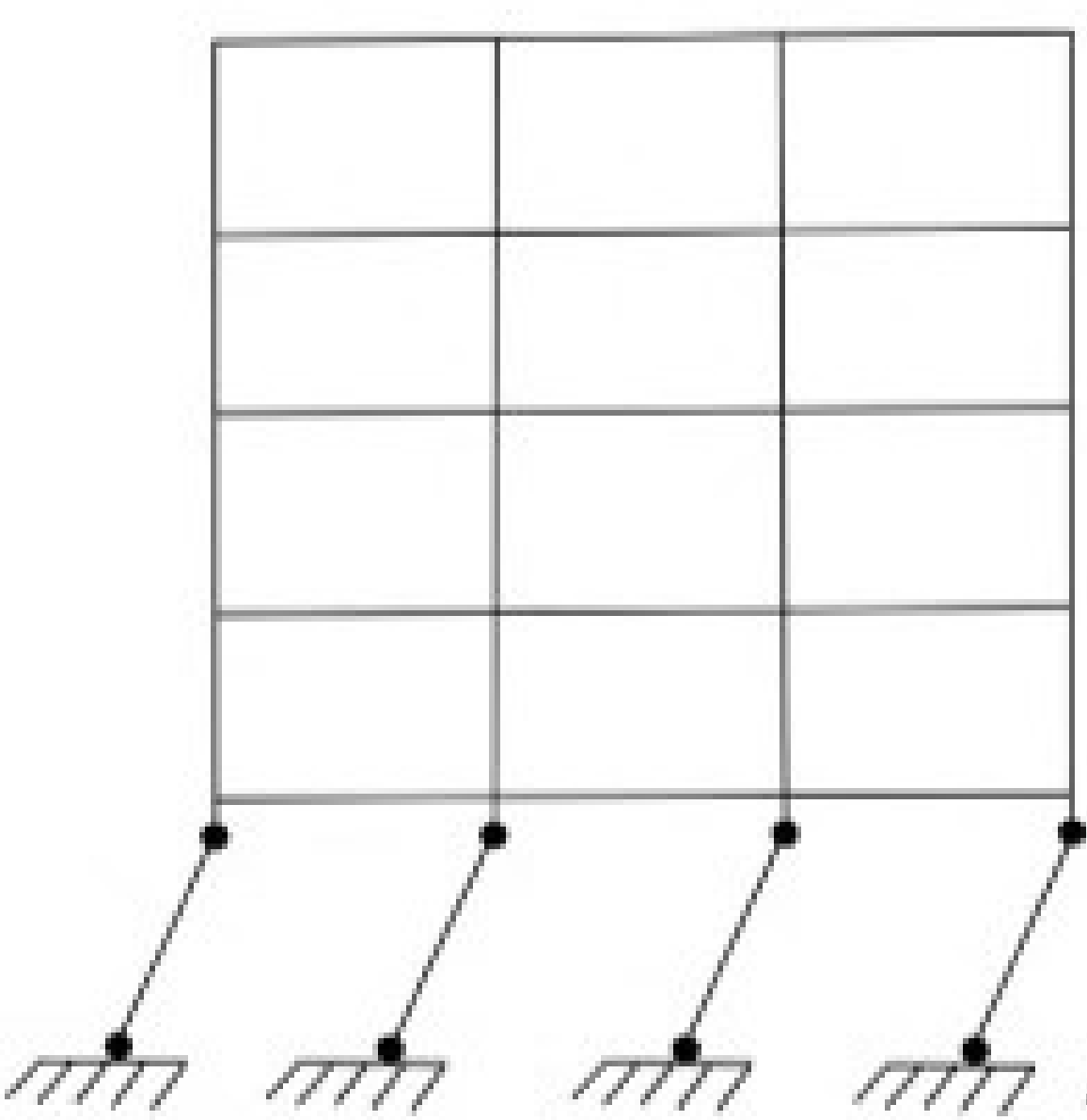
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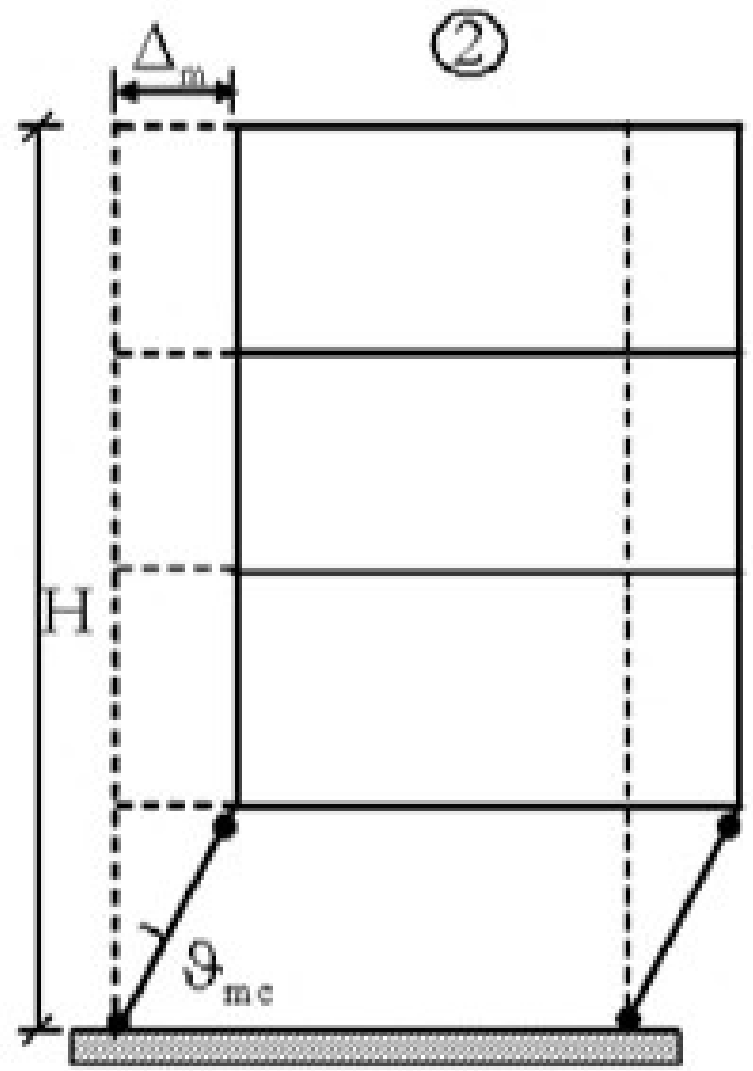
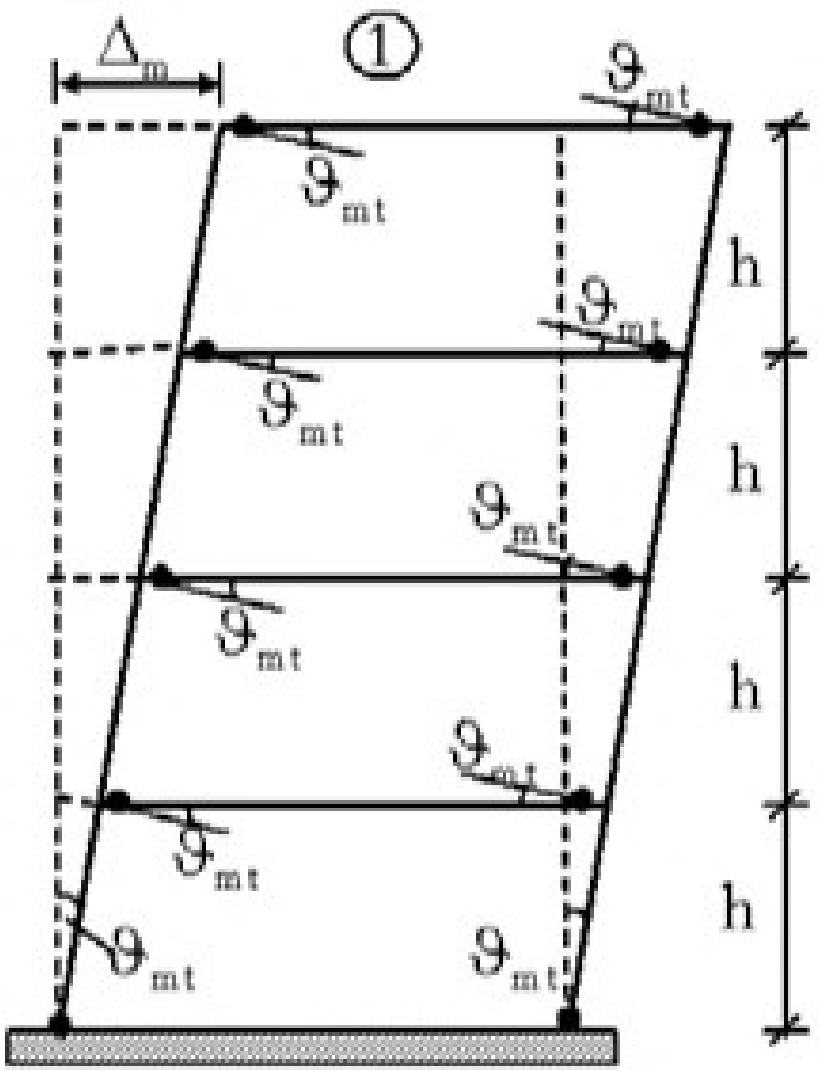
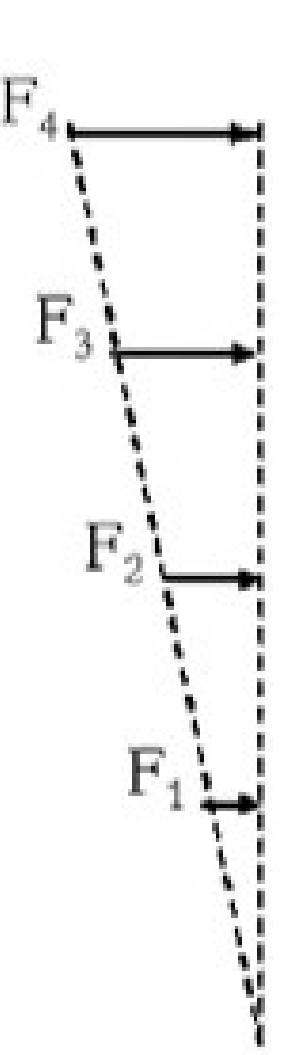
✗

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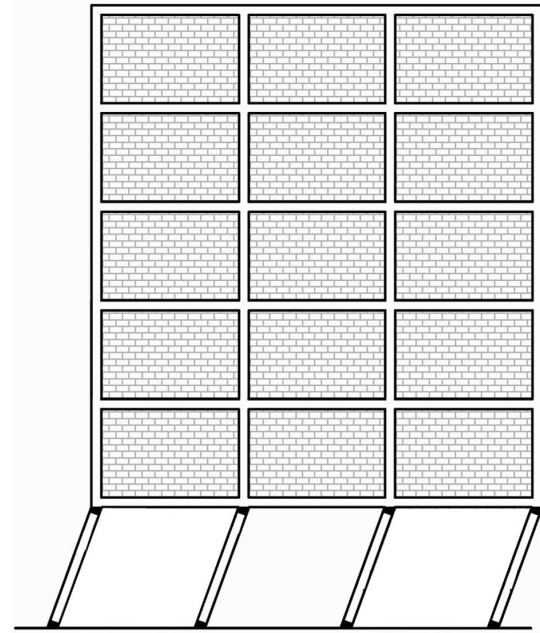
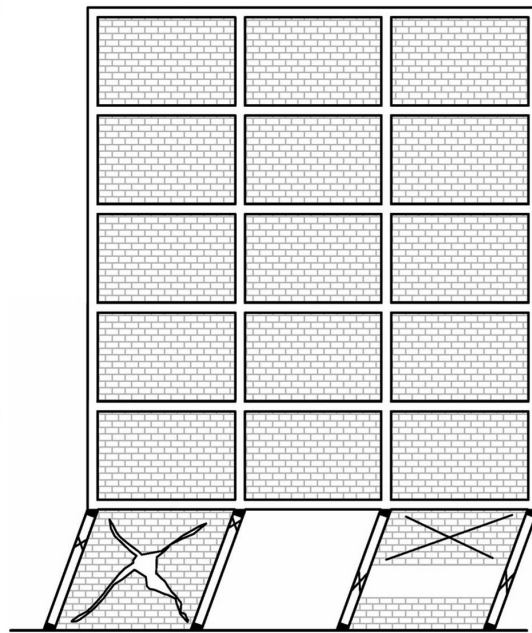
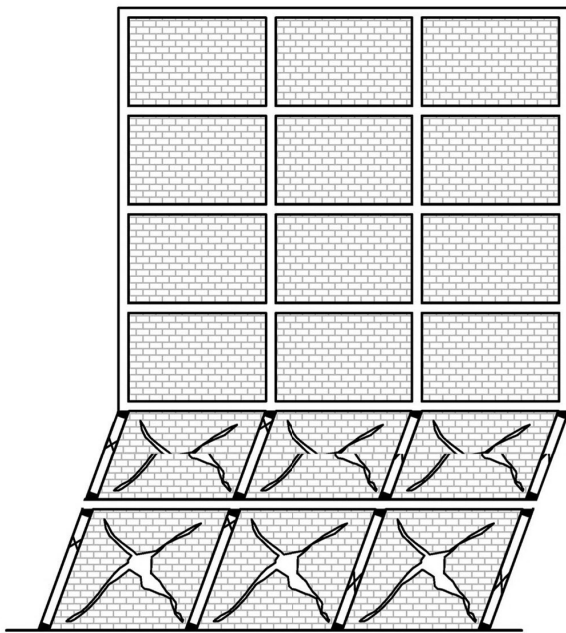
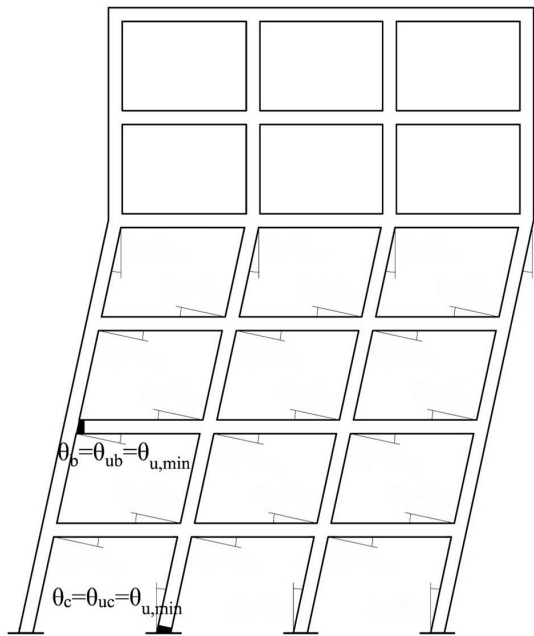
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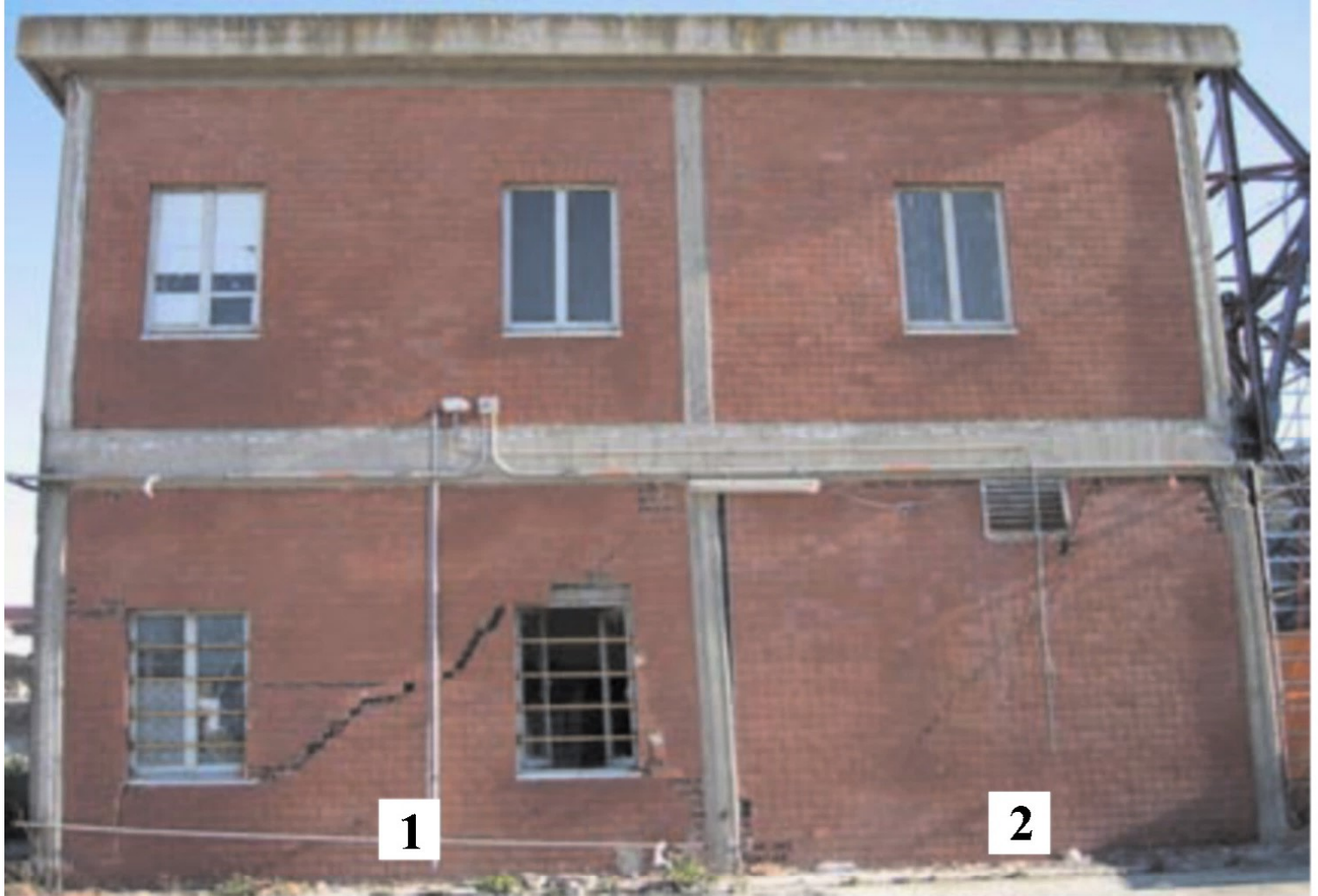






• Plastic Hinges

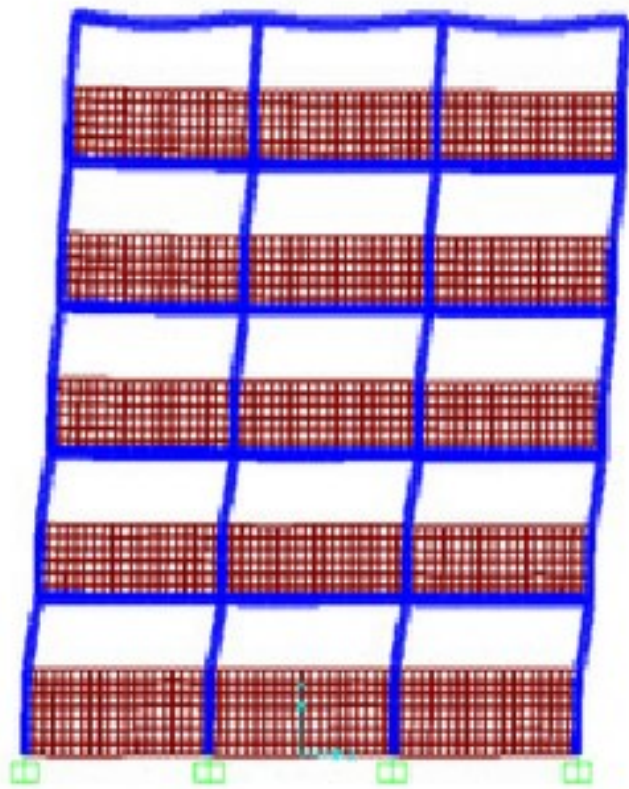




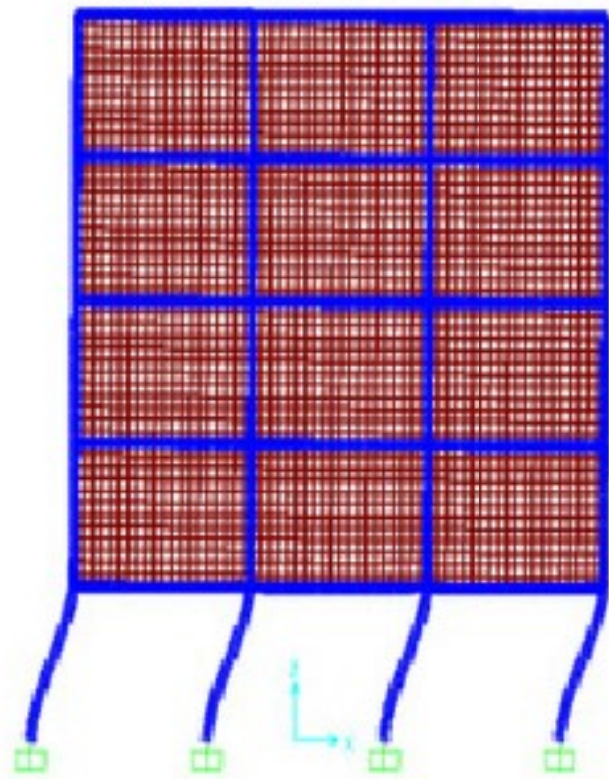
(a) West side



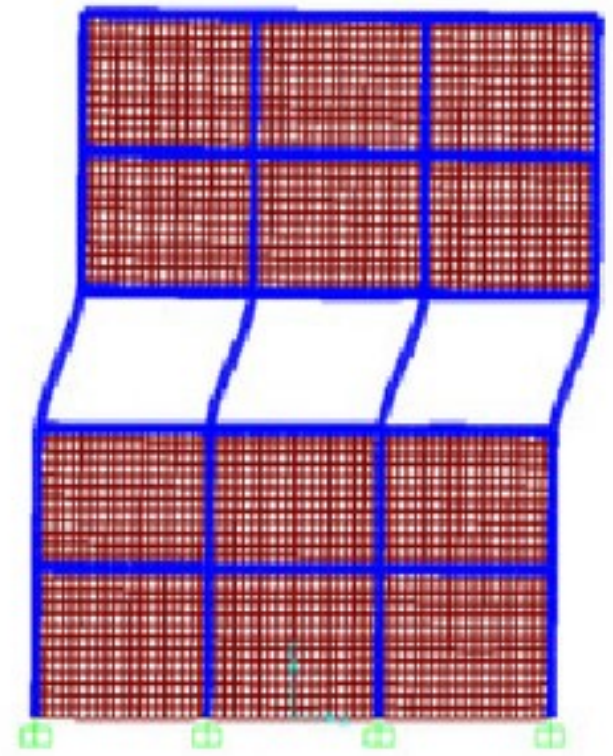
(b) East side



(a)



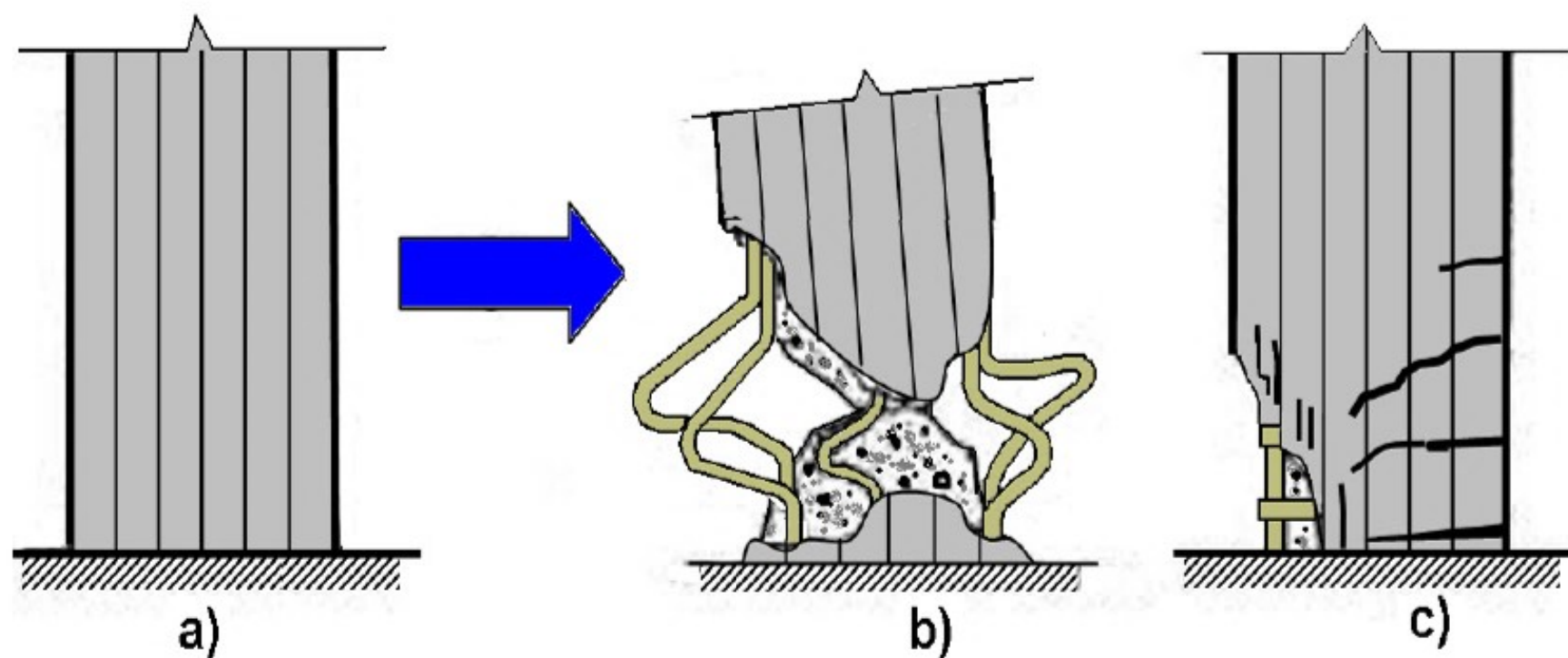
(b)



(c)



LESIONES Y DAÑOS EN PILARES DE LOS EDIFICIOS

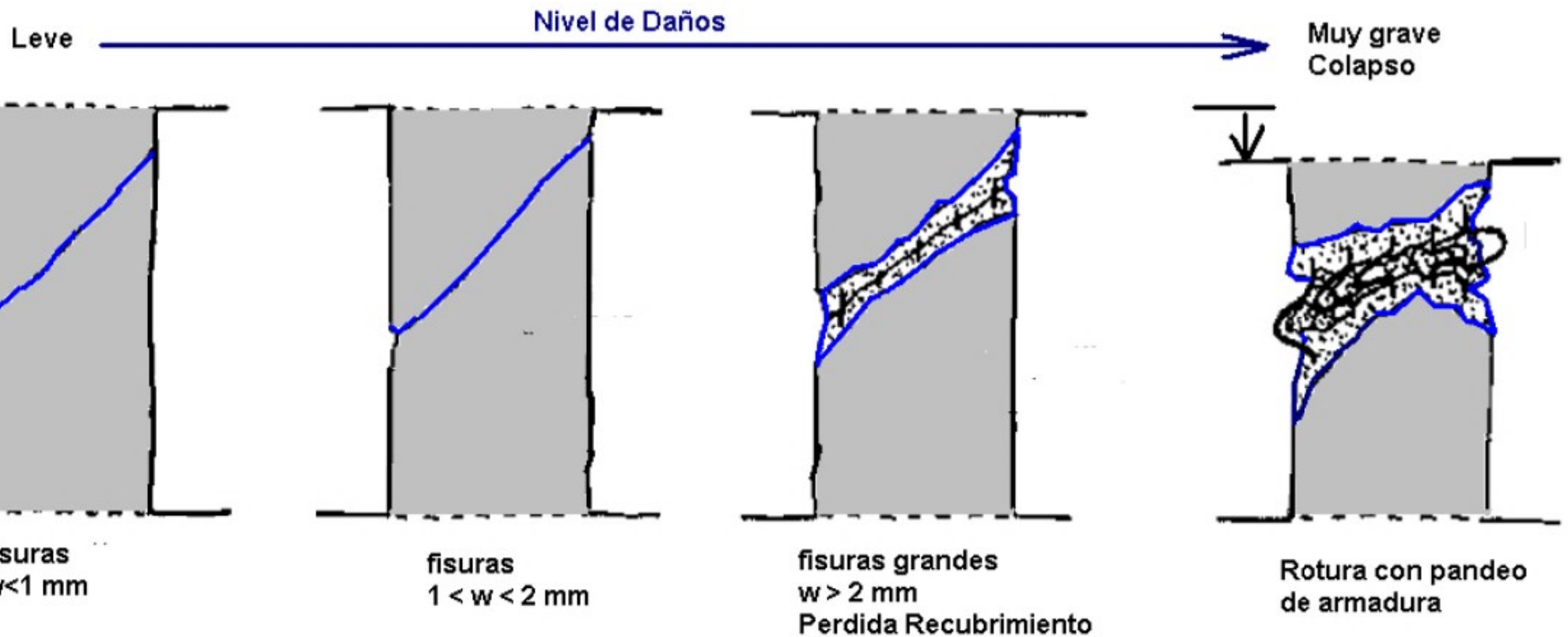


a) **Pilar Integro antes de la acción sísmica**

b) **Fallo a flexo-compresión (sin estribos de confinamiento ó muy separados)**

c) **Fallo a Flexo-compresión (con cercos juntos de confinamiento)**

LESIONES Y DAÑOS EN PILARES DE LOS EDIFICICIOS



Fisuración y rotura por Esfuerzo Cortante de Pilares de H.A



























(a)



(b)

Brittle concrete column**Stronger concrete column**

Cracks form in both concrete columns. In the poorly reinforced column at left, concrete chunks begin to fall. The well-reinforced column remains intact.



The brittle column begins to collapse as more chunks of concrete fall. Interlaced steel reinforcing bars hold the concrete in place in the strong column.



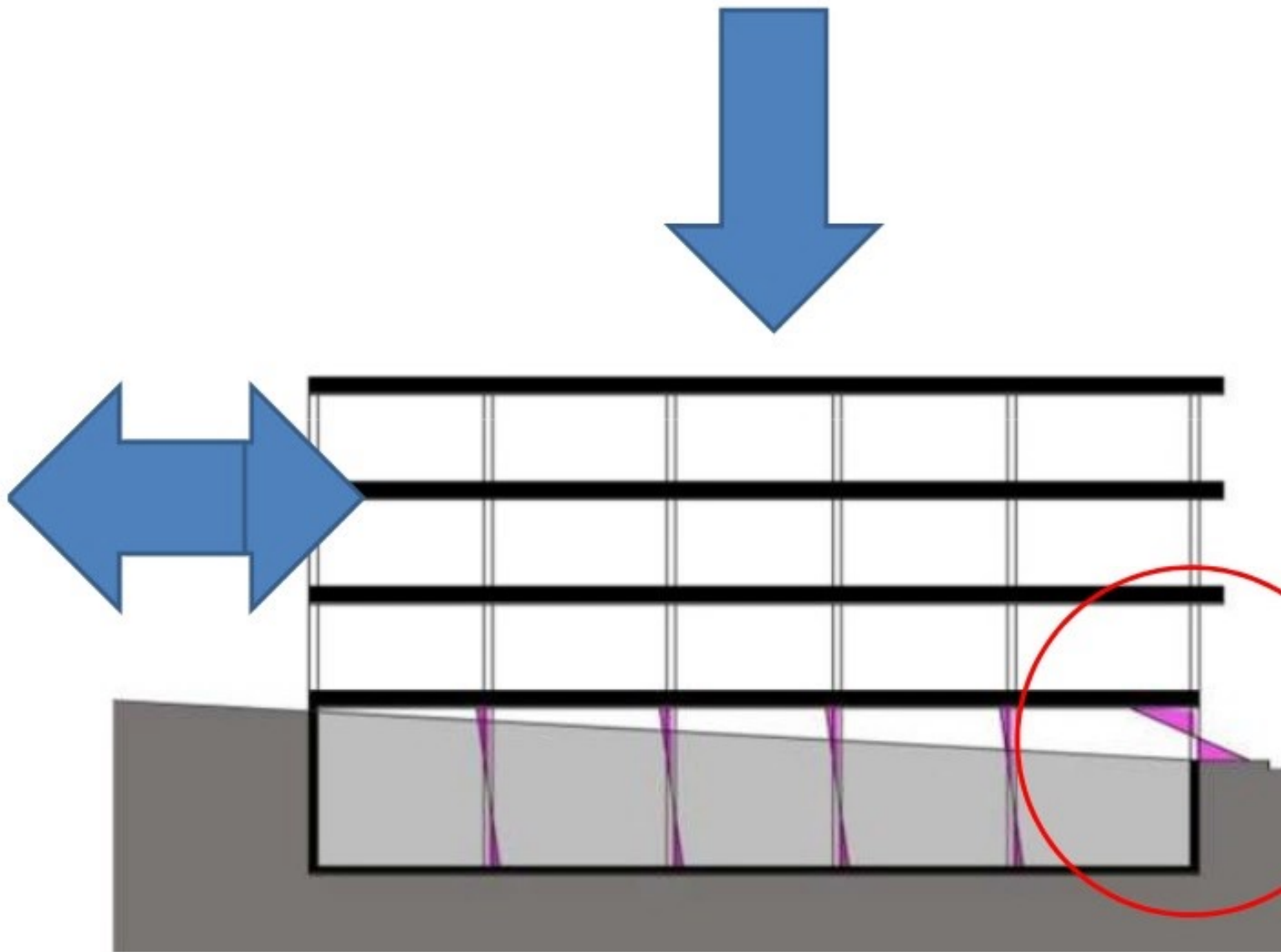
The weight of the building deforms the steel bars of the weak column, allowing the remaining concrete to explode out. The well-reinforced column bends sideways but retains its strength.



As weak columns fail throughout the building, occupants can be buried under tons of concrete. Strong columns may suffer some damage but still hold up the building's weight.



PILAR CORTO





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16.05.2011







short column damage

011





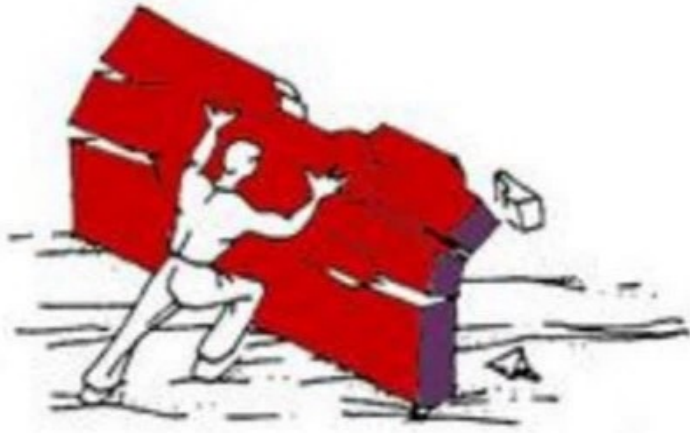






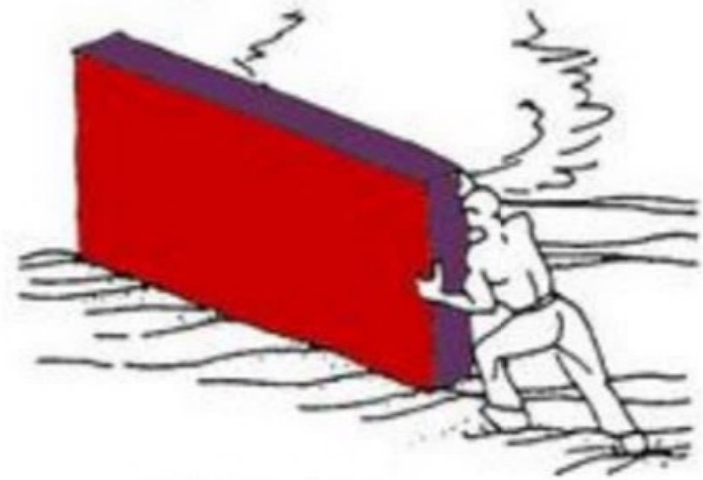


MECANISMOS BÁSICOS



OUT-OF-PLANE

Local

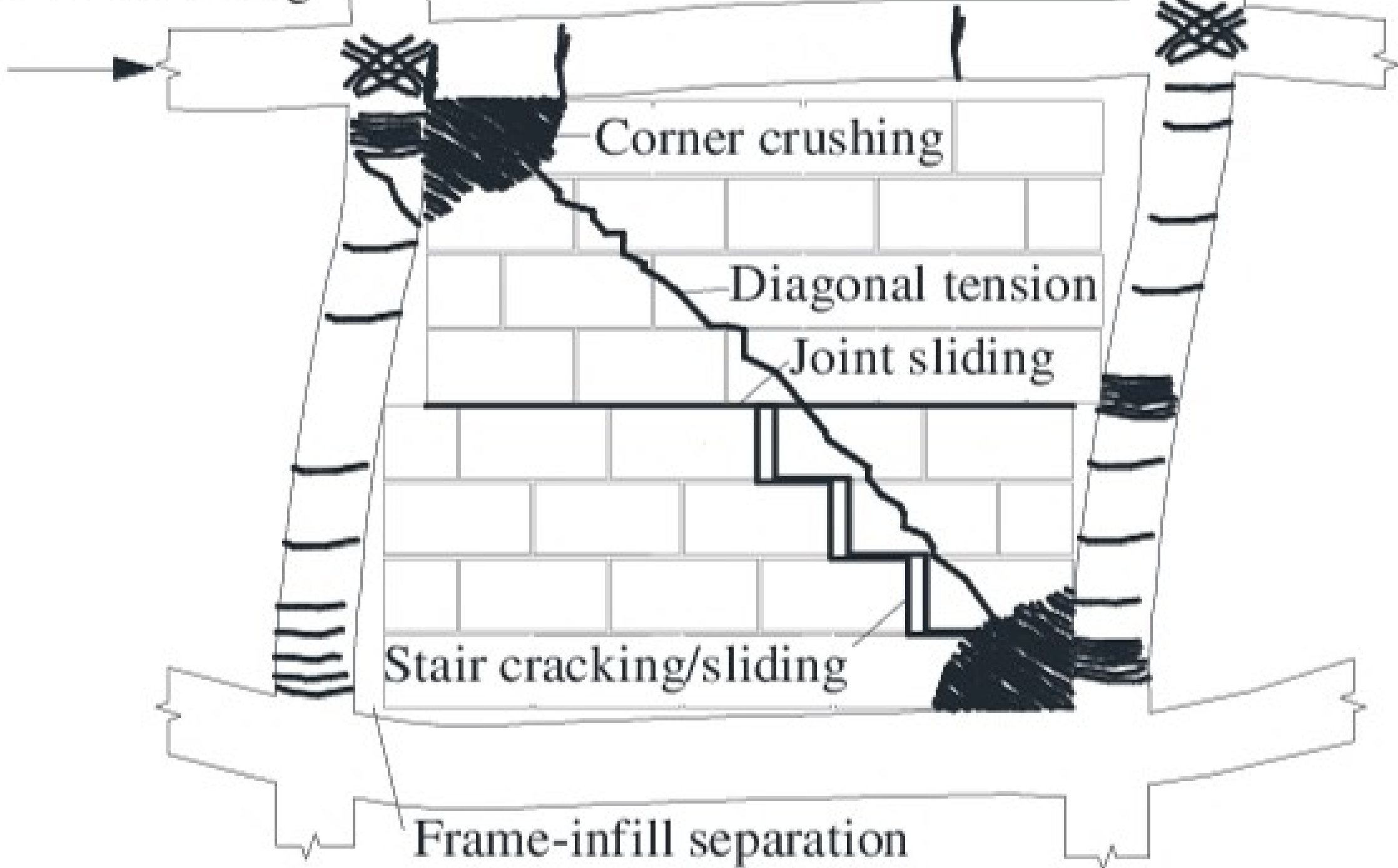


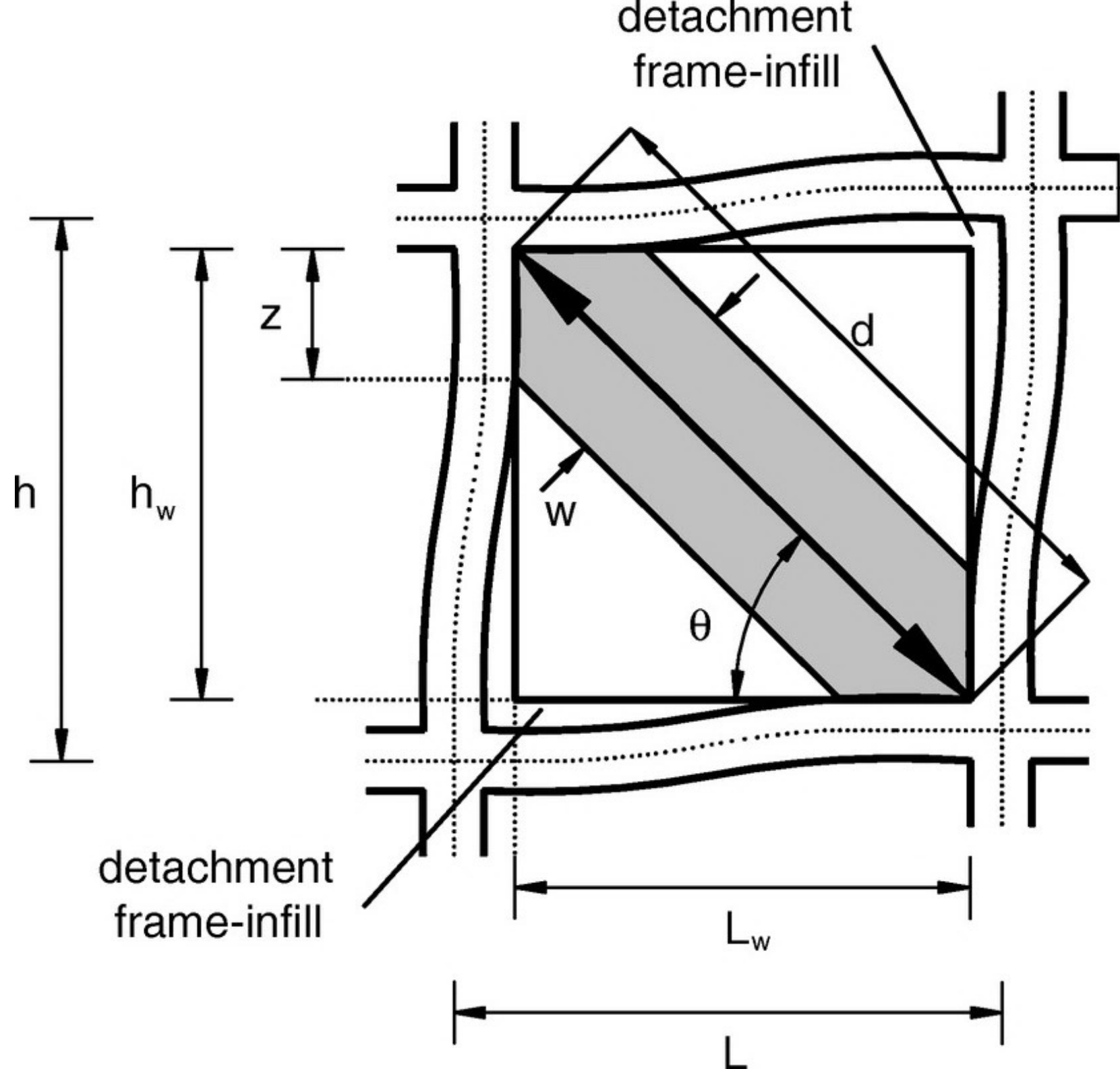
IN-PLANE

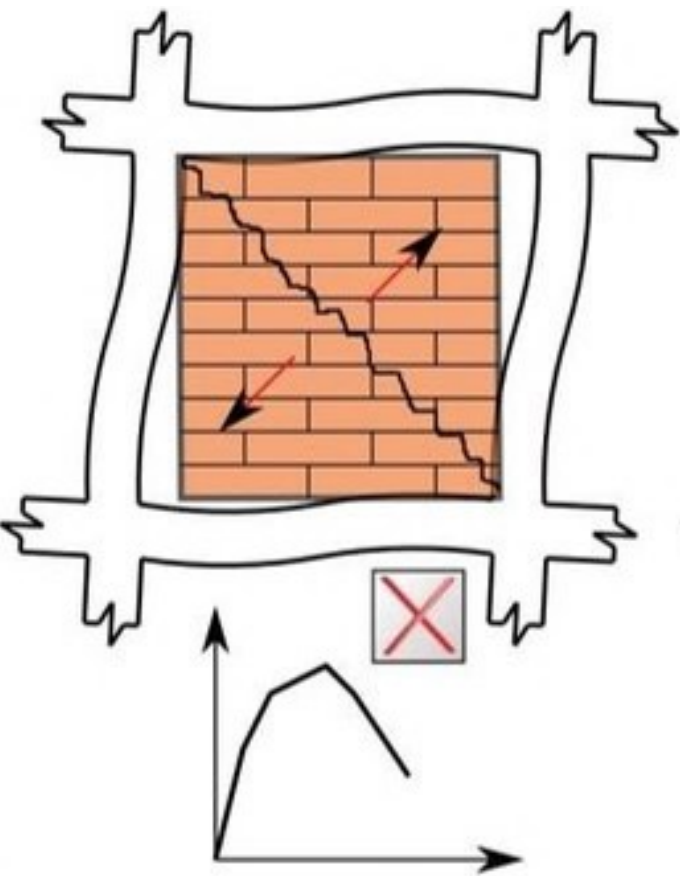
Global



Lateral loading

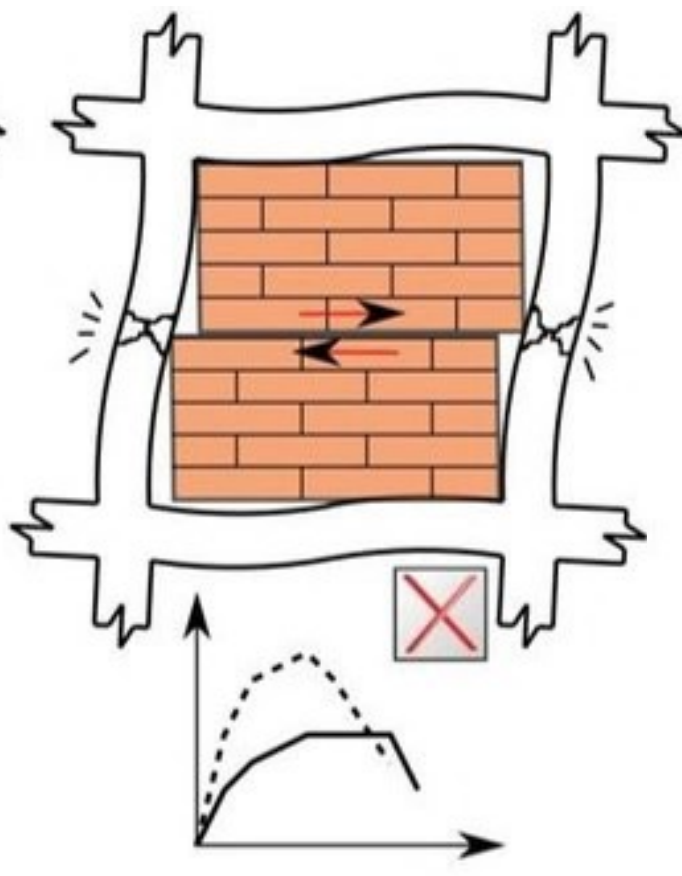






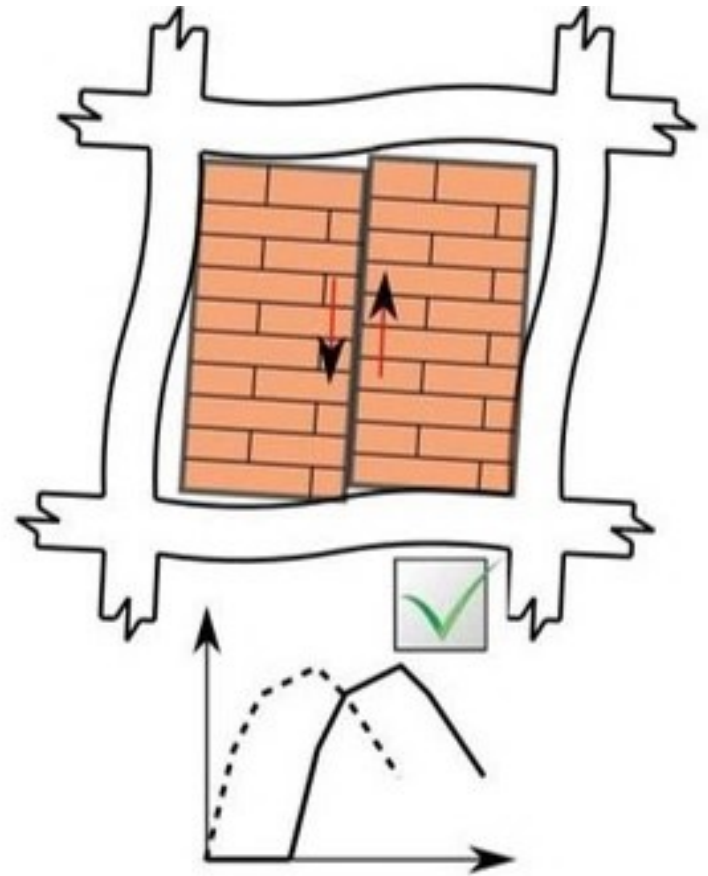
As Built Infill Wall

- Brittle strut mechanism
- Low deformation capacity
- Brittle diagonal cracking



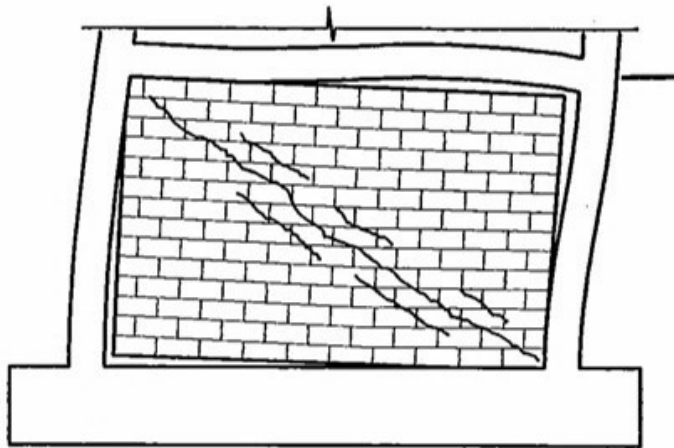
Sliding Infill Wall

- Ductile sliding mechanism
- Low-moderate deformation capacity
- Potentially brittle column shear failure

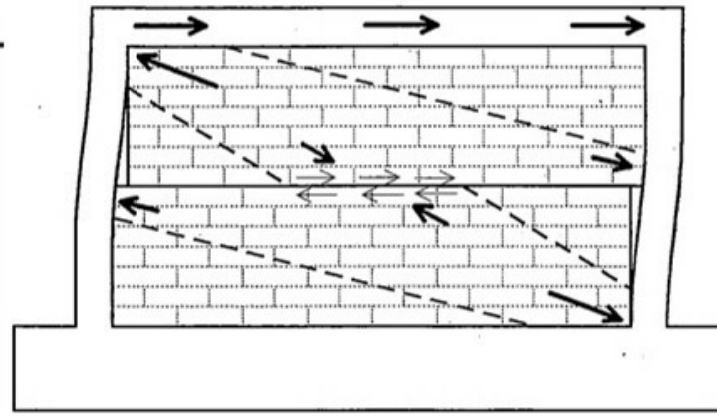


Rocking Infill Wall (Low Damage)

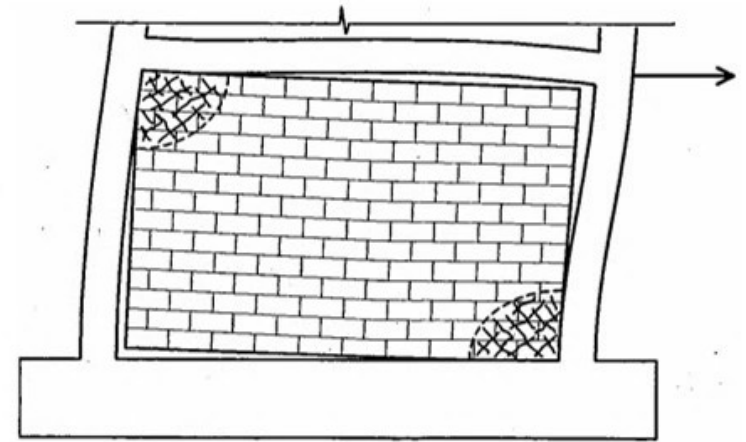
- Ductile caltlever wall mechanism
- Moderate-high deformation capacity (Controlled by the amount of gaps)
- Delayed strut action by vertical gaps (low damage)



Puntal diagonal



Deslizamiento horizontal



Aplastamiento de esquinas

SE VENDE O SE ALQUILA
LOCAL COMERCIAL
CON SALIDA DE HUMOS
174 m² - 33 ml. DE FACHADA 677 48 58 30

CALLE
SAN FERNANDO

DEMOLER PARED







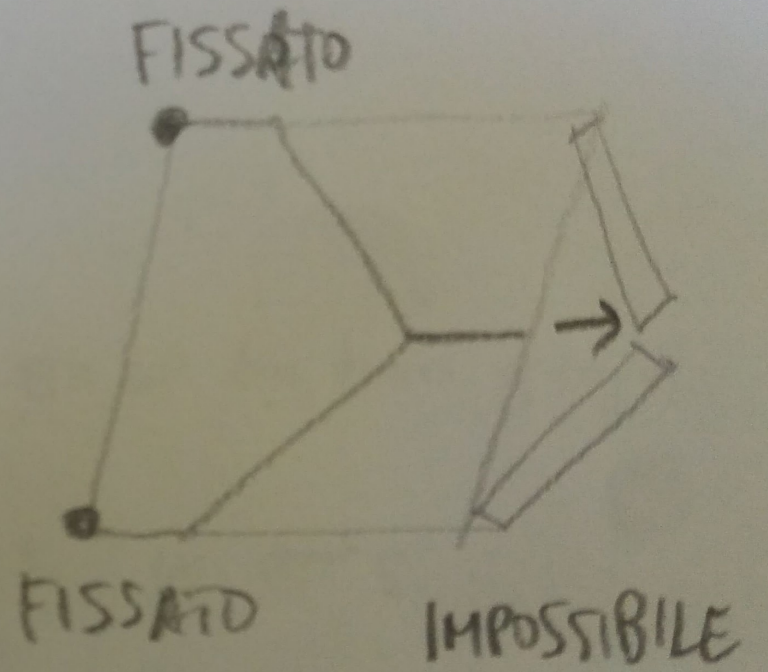
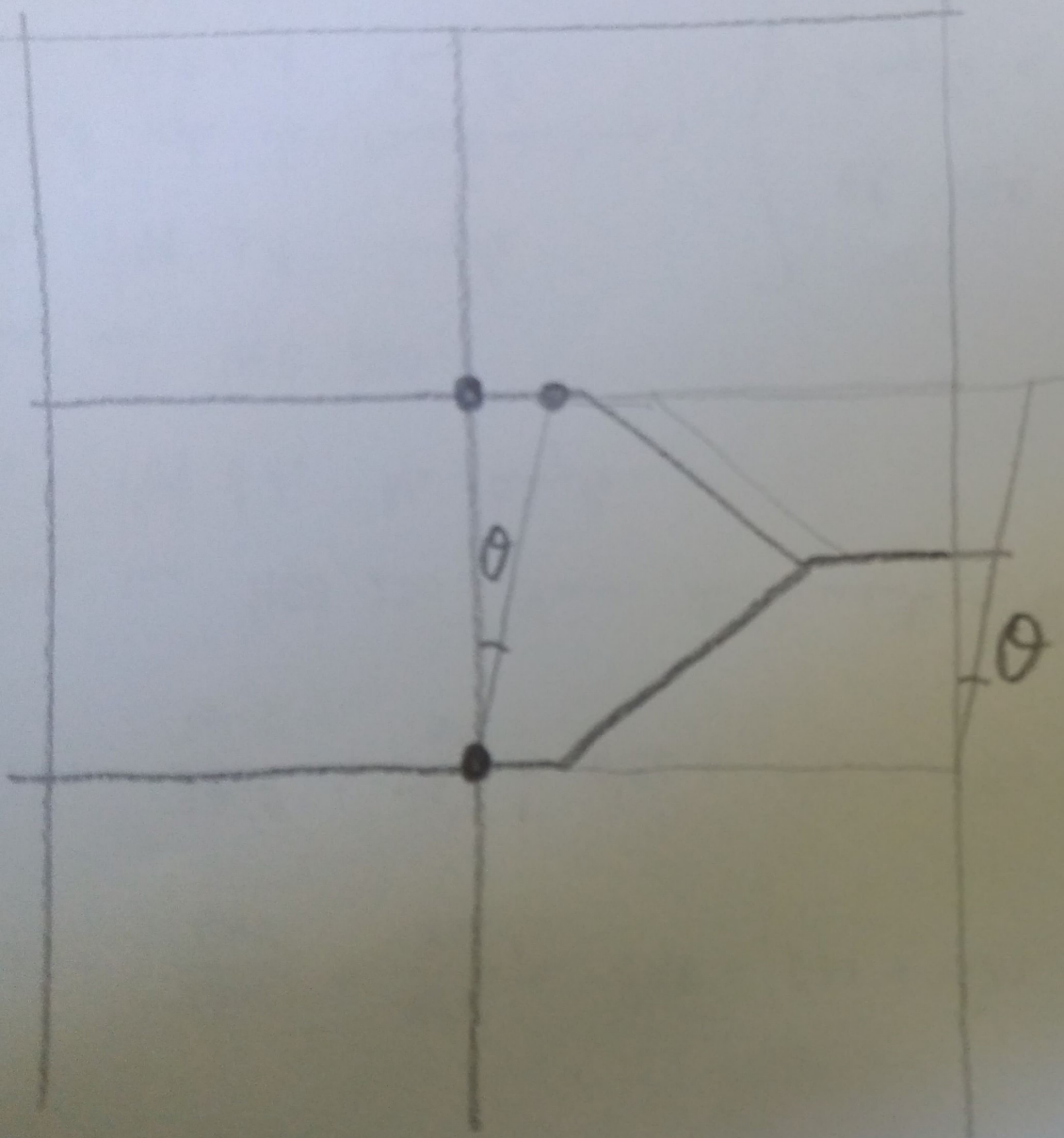


P29





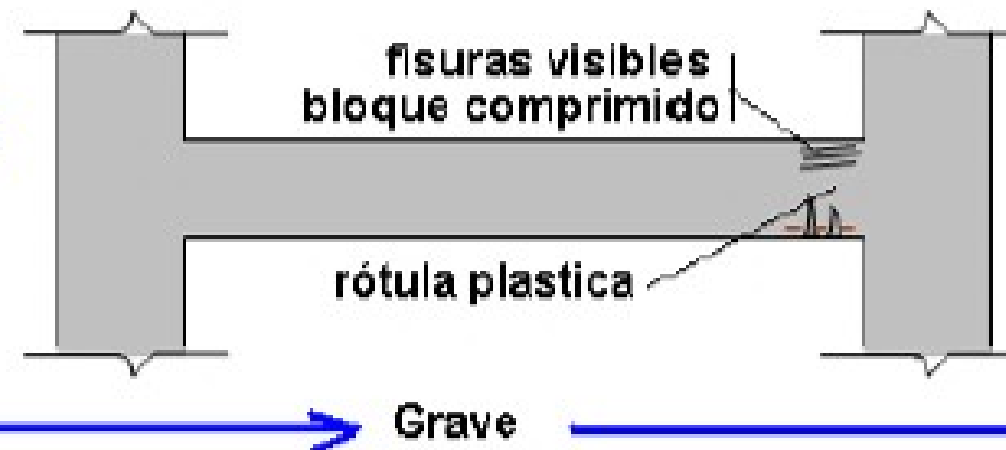
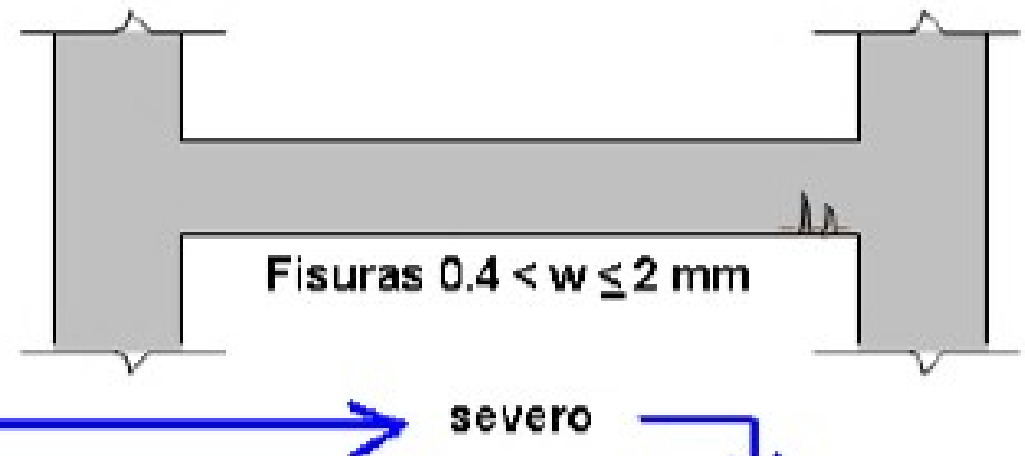
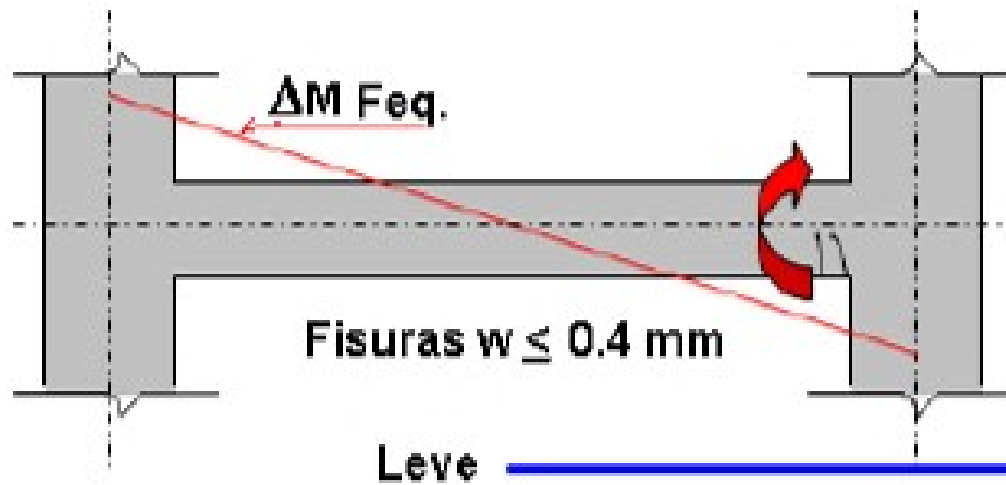


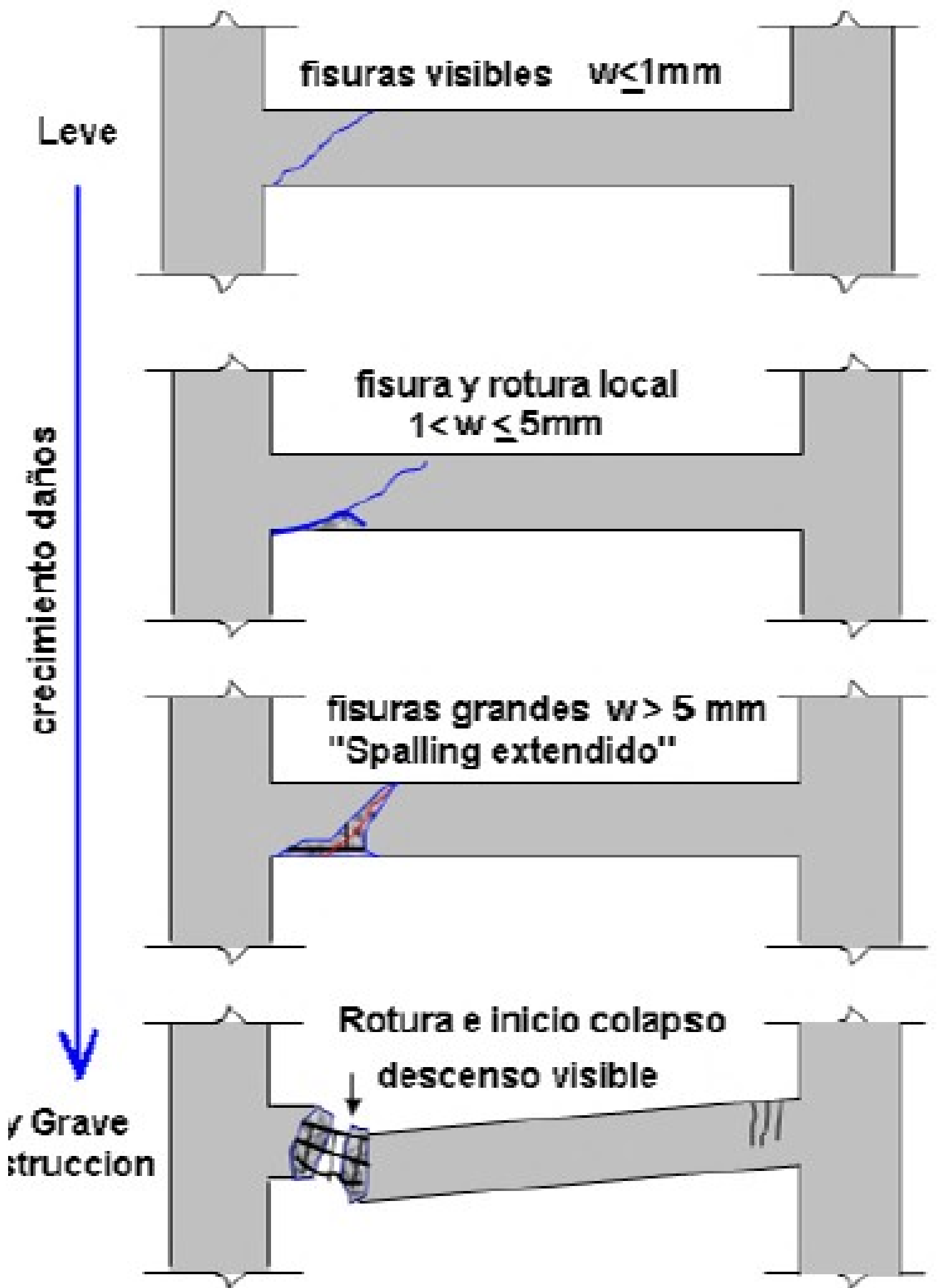






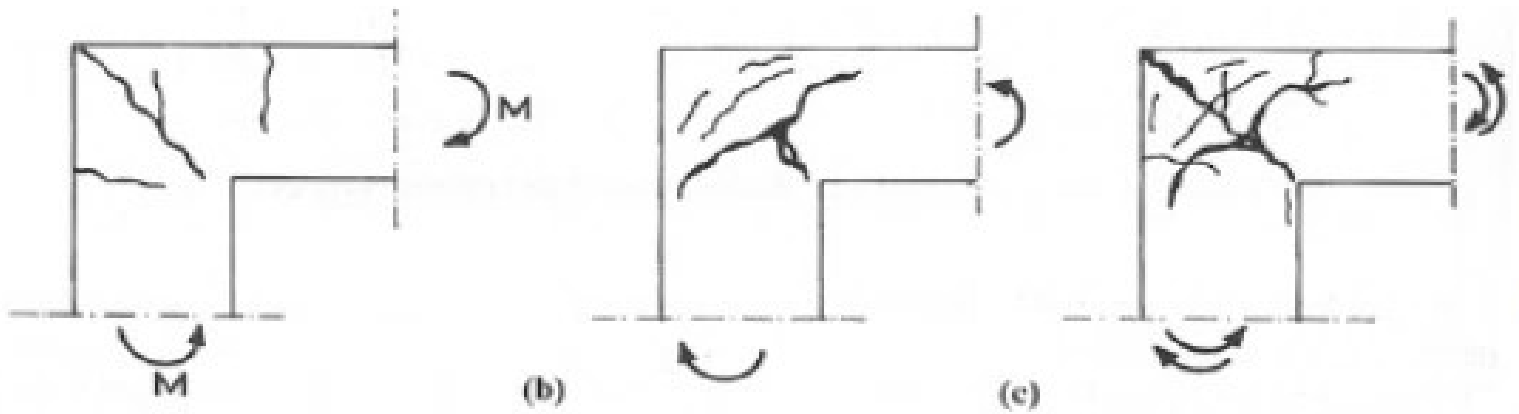




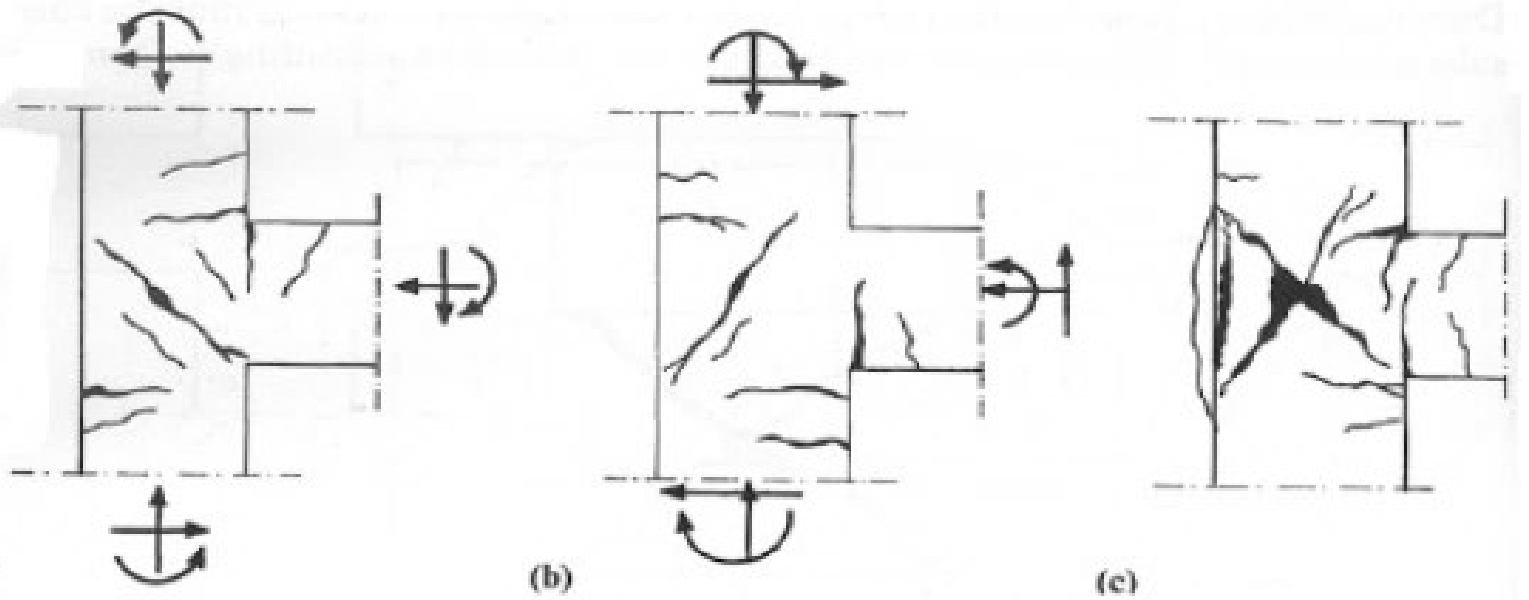


FALLOS A CORTANTE EN VIGAS

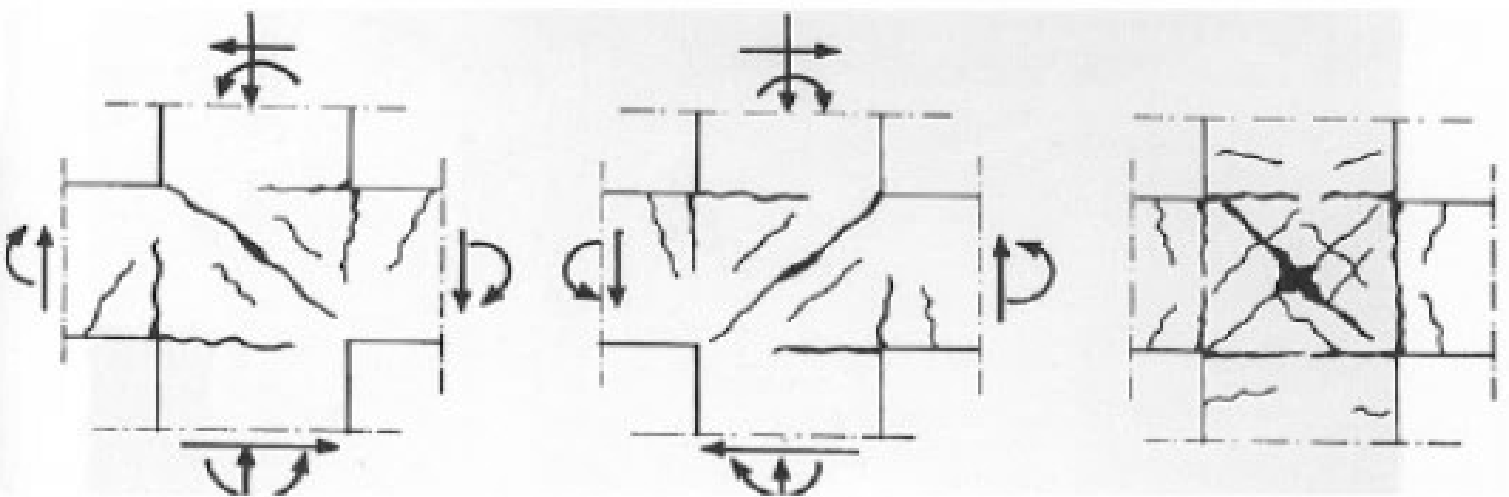




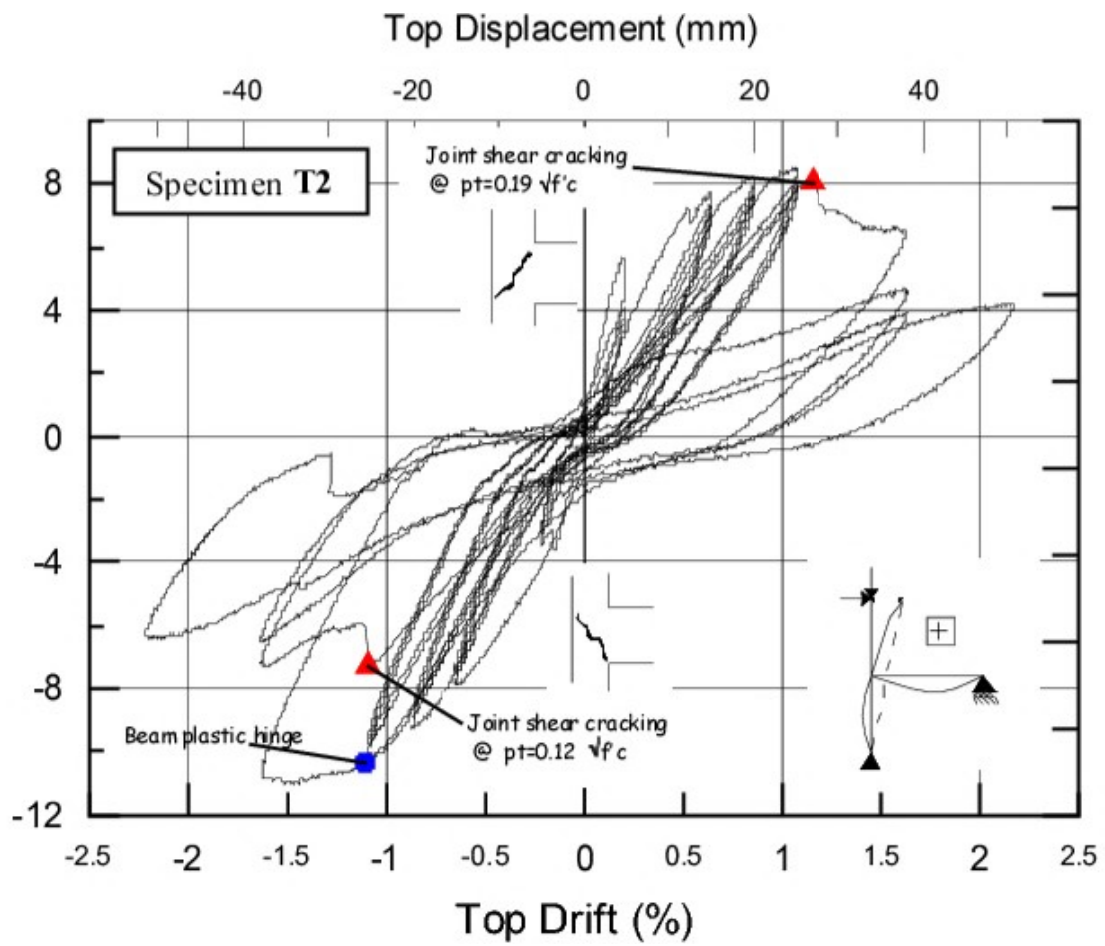
colapso nudo de esquina .



colapso de nudo de borde



colapso de nudo interior





a)



b)



c)







(a)



(b)



(c)



(d)

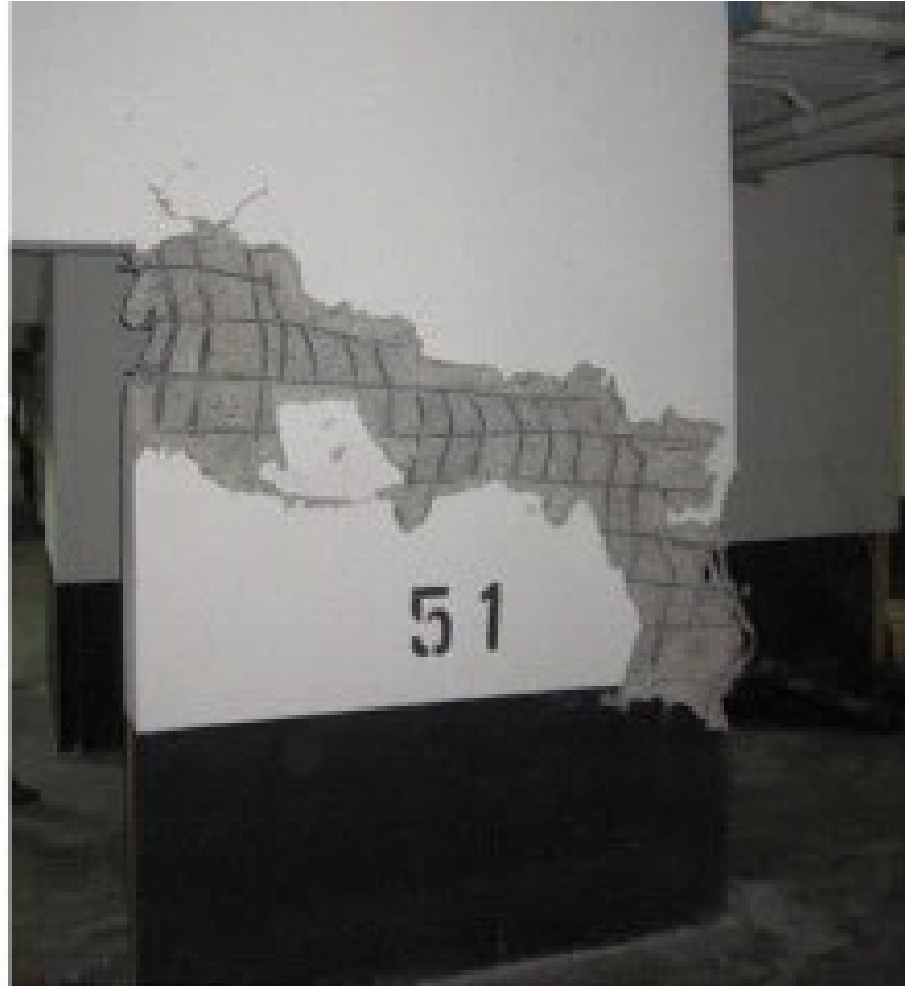


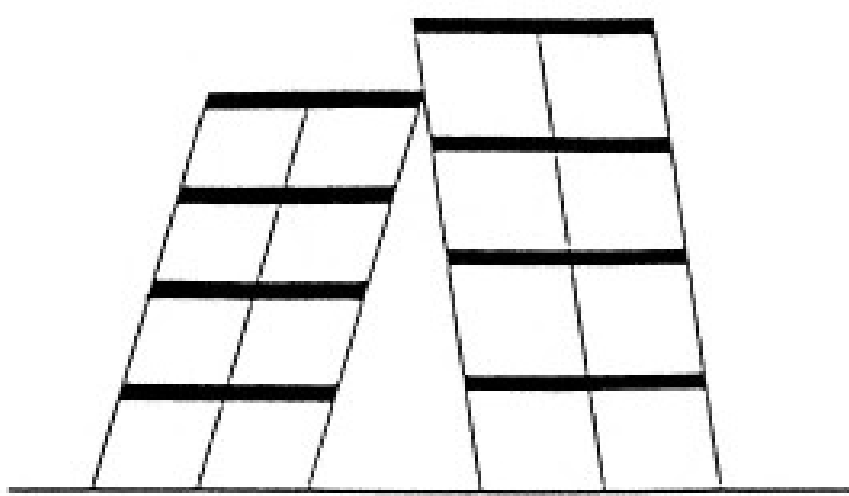
(a)



(b)



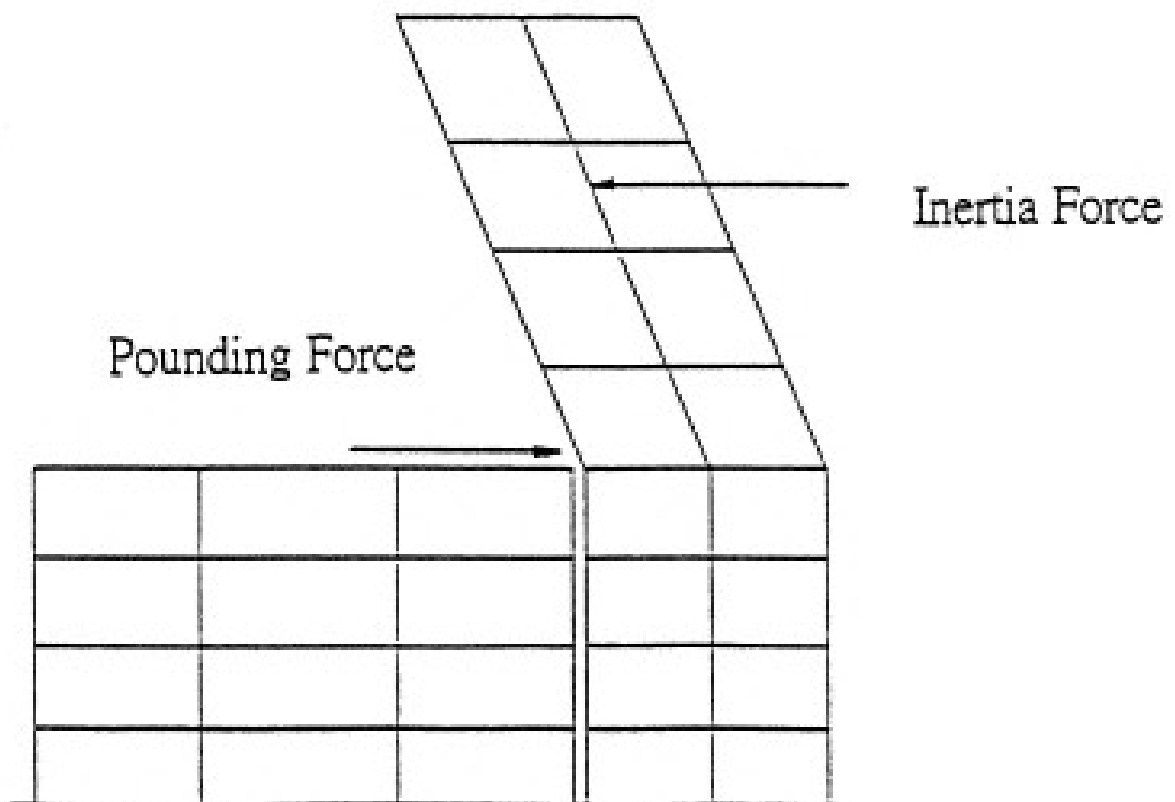




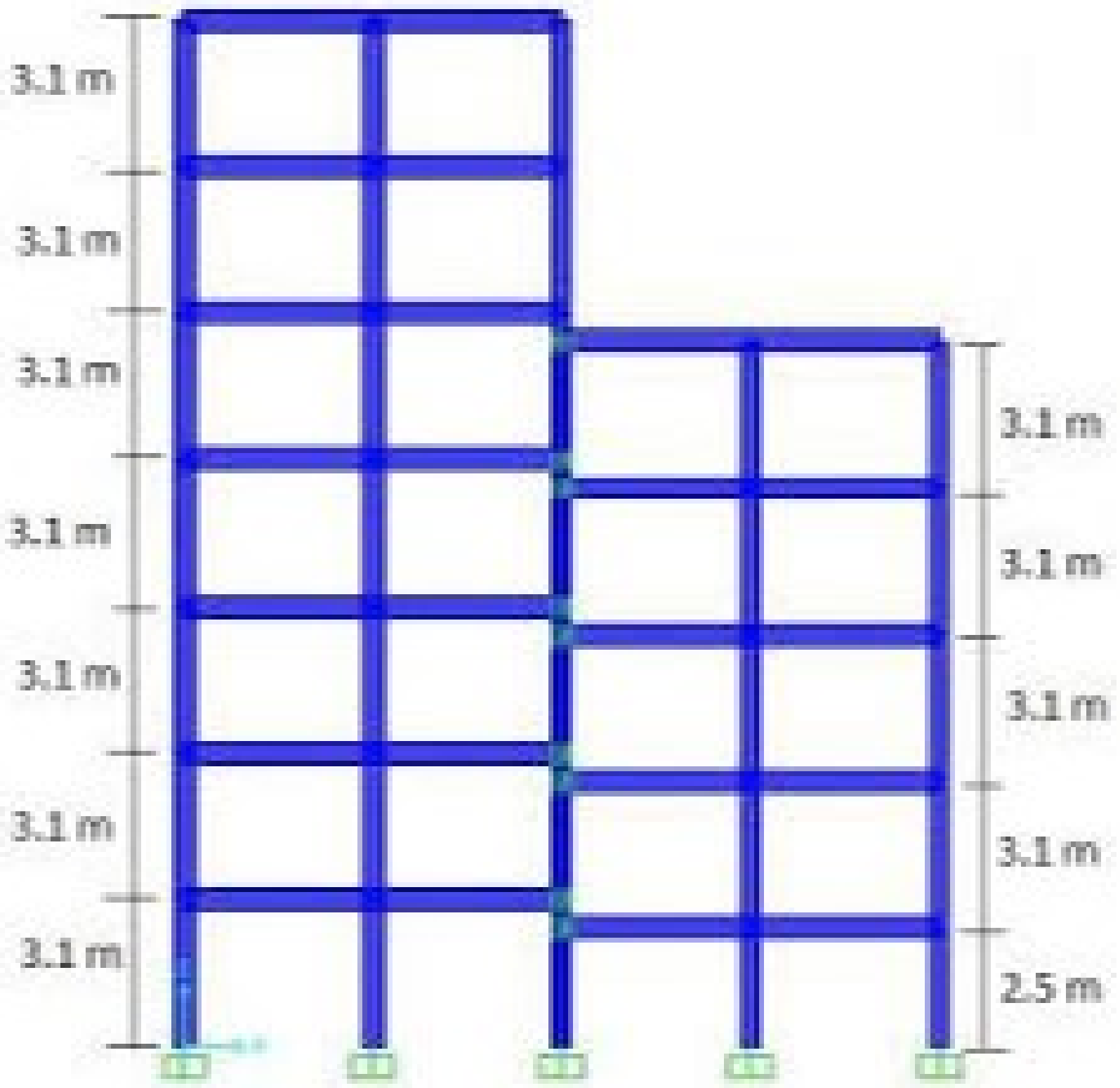
(a) Mid-column Pounding



(b) Heavier Adjacent Building Pounding



(c) Taller Adjacent Building Pounding







(b)





















