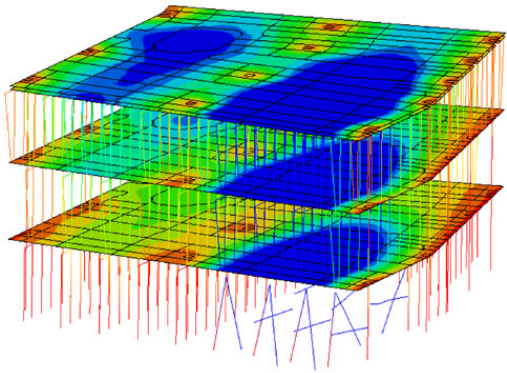
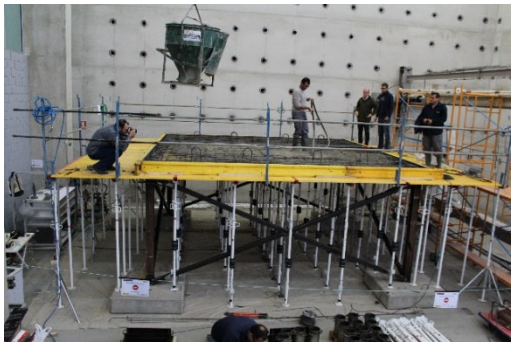
UNIVERSITAT POLITÈCNICA DE VALÈNCIA

ICITECH
CIENCIA Y TECNOLOGÍA DEL HORMIGÓN

UNIVERSITY OF SURREY

ASSESSMENT OF RC BUILDING STRUCTURES UNDER CONSTRUCTION SUBJECTED TO THE SUDDEN FAILURE OF SHORING ELEMENTS





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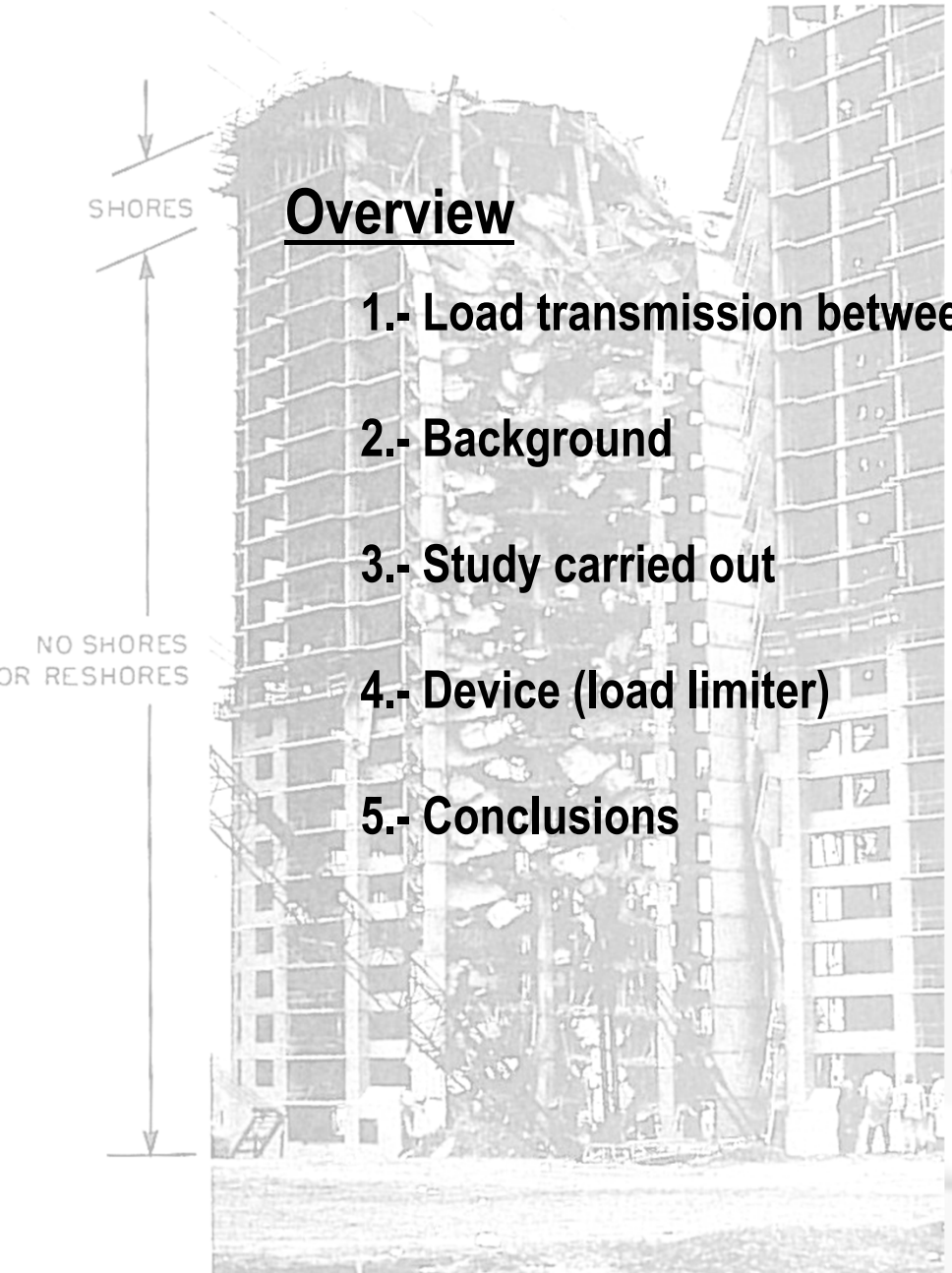
STRUCTURAL FAULTS & REPAIR
Edinburgh – May, 15th 2018



Overview

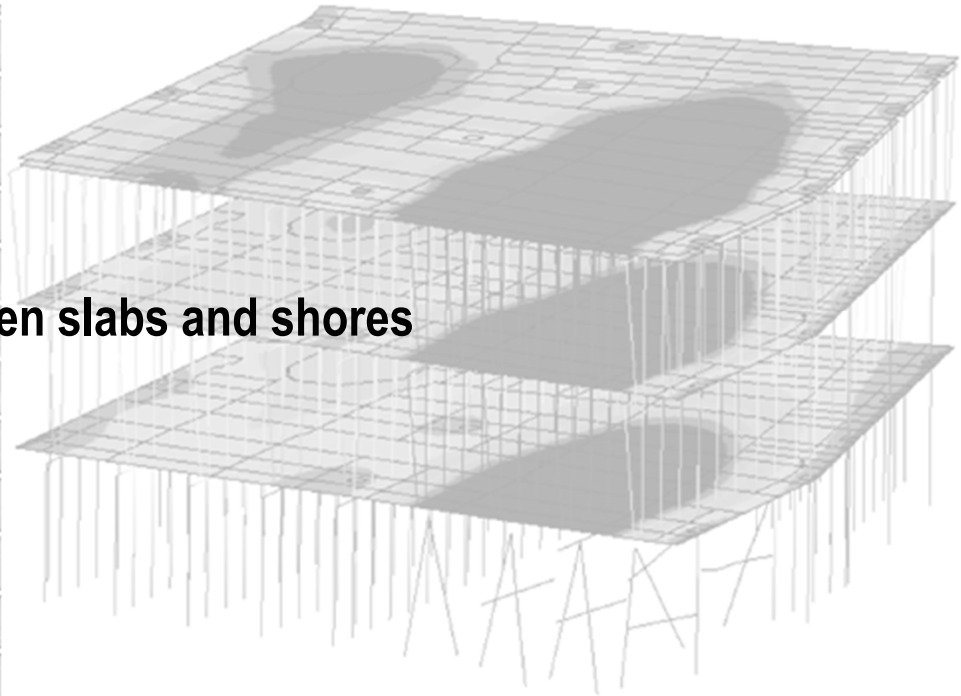
1.- Load transmission between slabs and shores

2.- Background

3.- Study carried out

4.- Device (load limiter)

5.- Conclusions



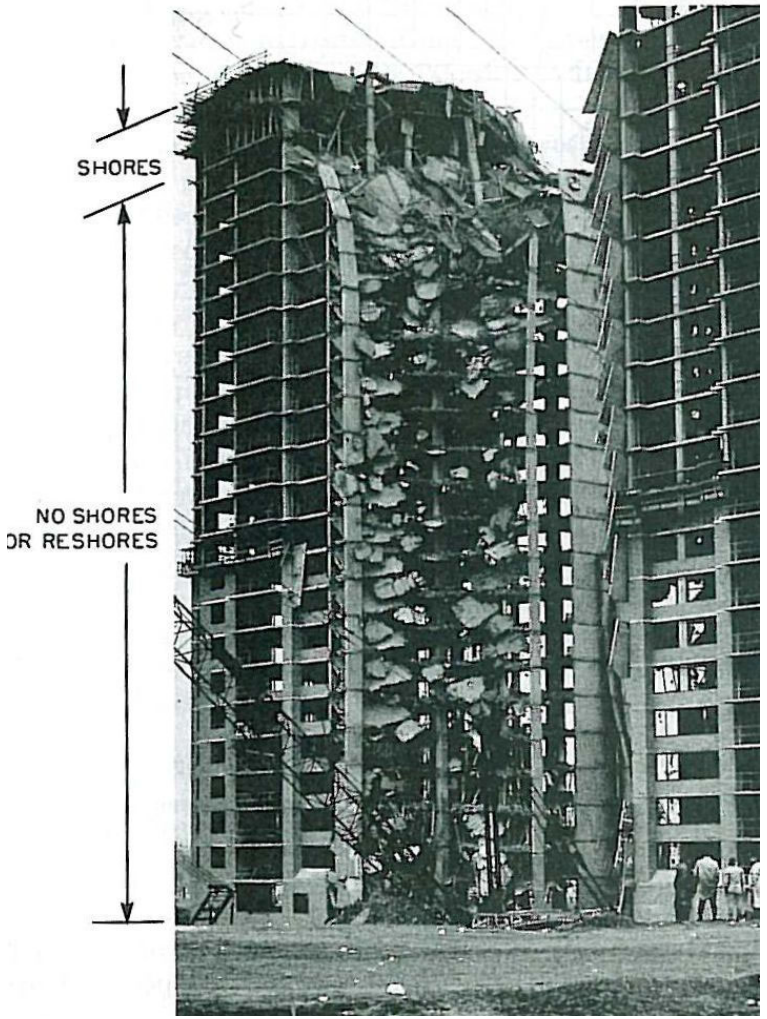
1. LOAD TRANSMISSION BETWEEN SLABS AND SHORES

Why is this issue important?

1. LOAD TRANSMISSION BETWEEN SLABS AND SHORES

Colapse

http://www.levante-emv.com/comunitat-valenciana/2009/09/17/obra-consell-encargo-urgencia-arropar-camps-carlet-hunde/632082.html (accessed April 25, 2018).

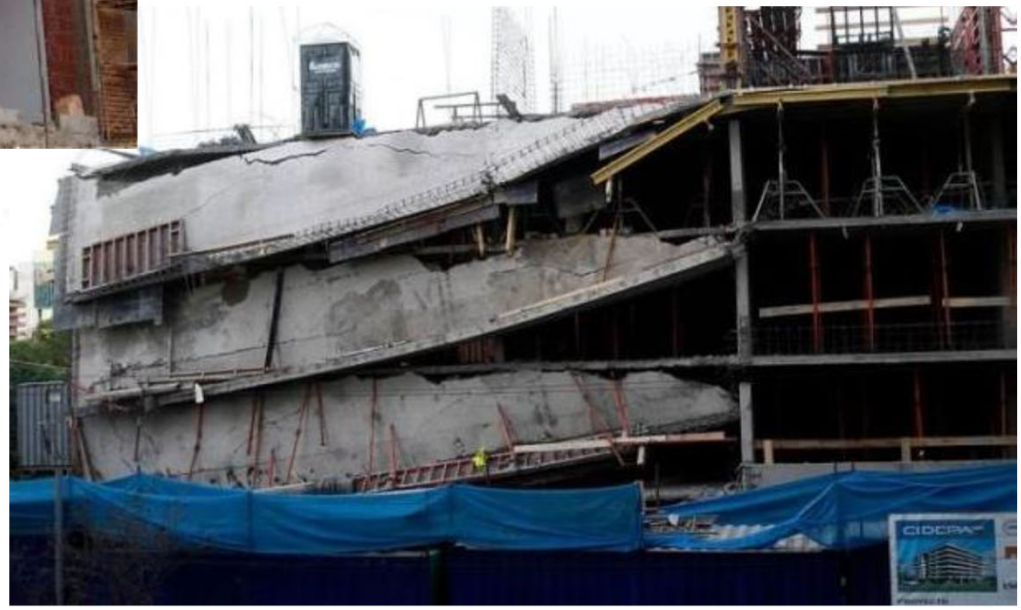


Early striking was the main cause of collapse of the two towers (Skyline Center Project – Virginia). Kaminetzky (1994)

1. LOAD TRANSMISSION BETWEEN SLABS AND SHORES

Colapse

http://www.eltiempo.com/colombia/otras-ciudades/se-derumba-alcaldia-de-gramalote/16629364 (accessed April 25, 2018).



http://www.diariodemallorca.es/sucesos/2015/09/21/derrumbe-victimas-sarenal/1056712.html (accessed April 25, 2018).

1. LOAD TRANSMISSION BETWEEN SLABS AND SHORES

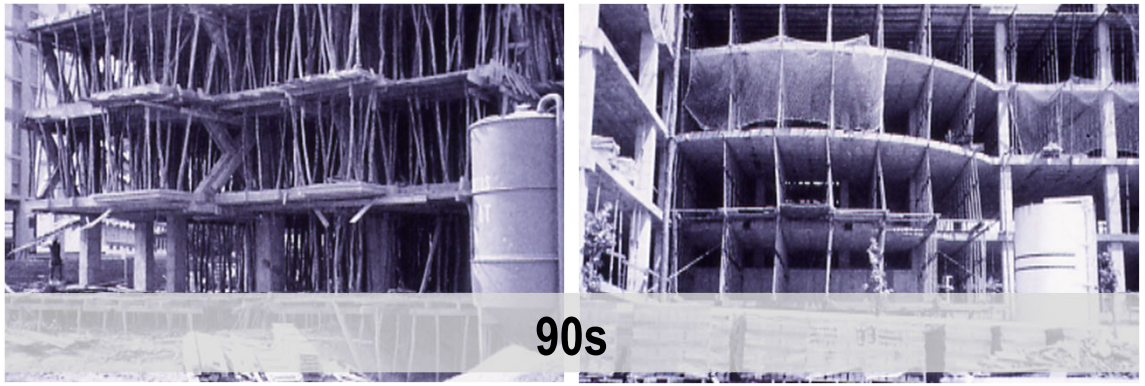
Damage (slabs and shores)

C.L. Freyermuth, Structural integrity of buildings constructed with unbonded tendons, Concr. Int. 11 (1989) 56–63.

2. BACKGROUND

More than 30 years…

80s

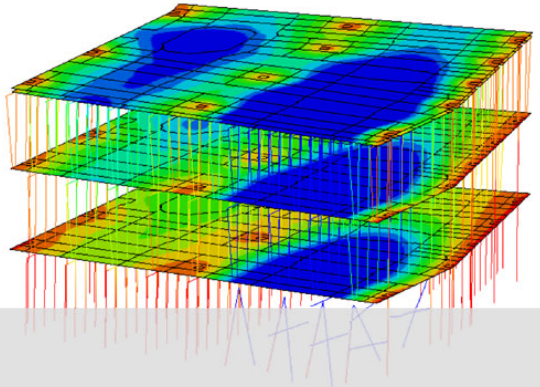


90s

2004-2008

2008-2012

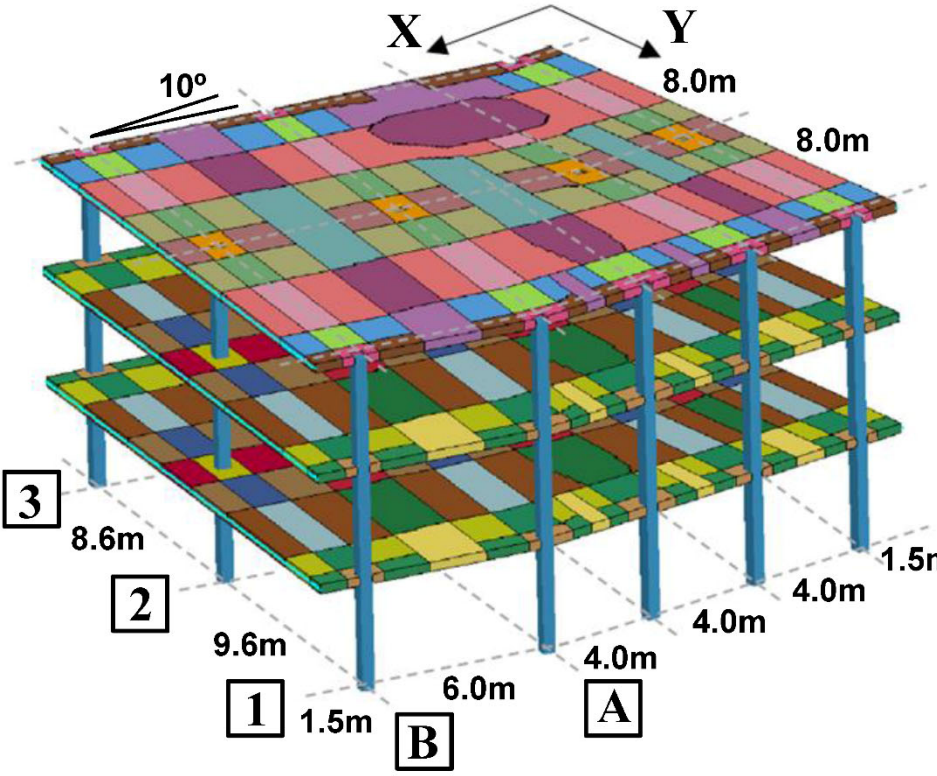
2012-2018

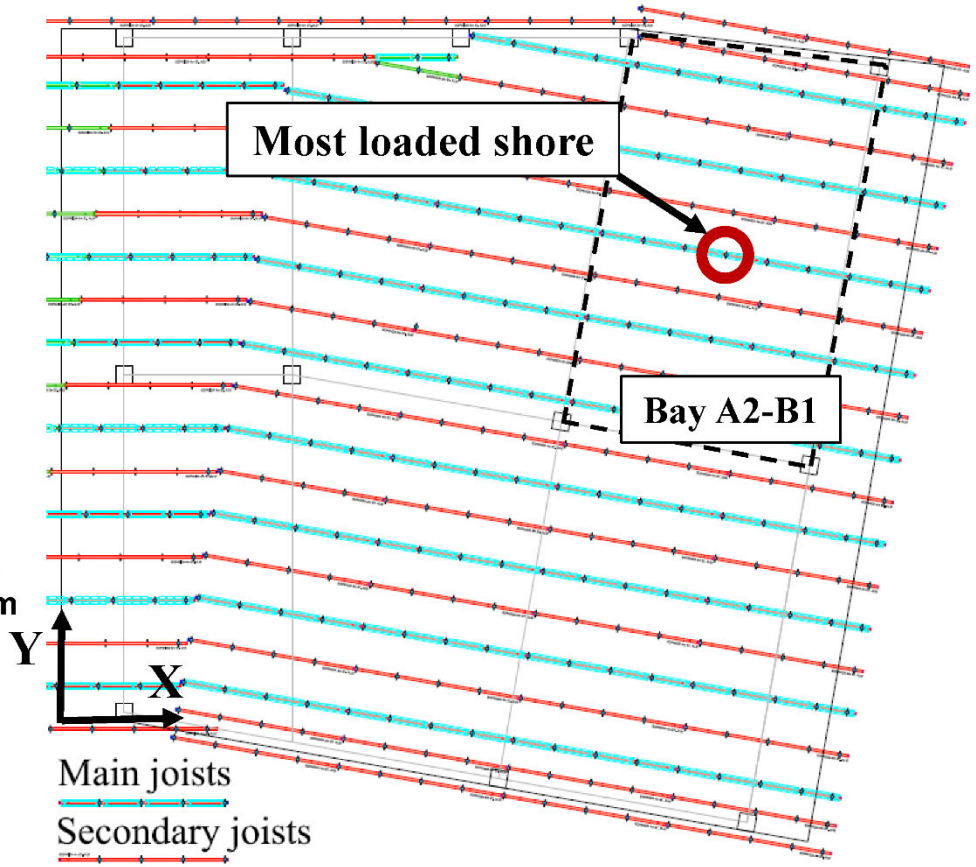


3. STUDY CARRIED OUT

First approach to the effects of sudden failure of shoring elements during the construction of RC building structures

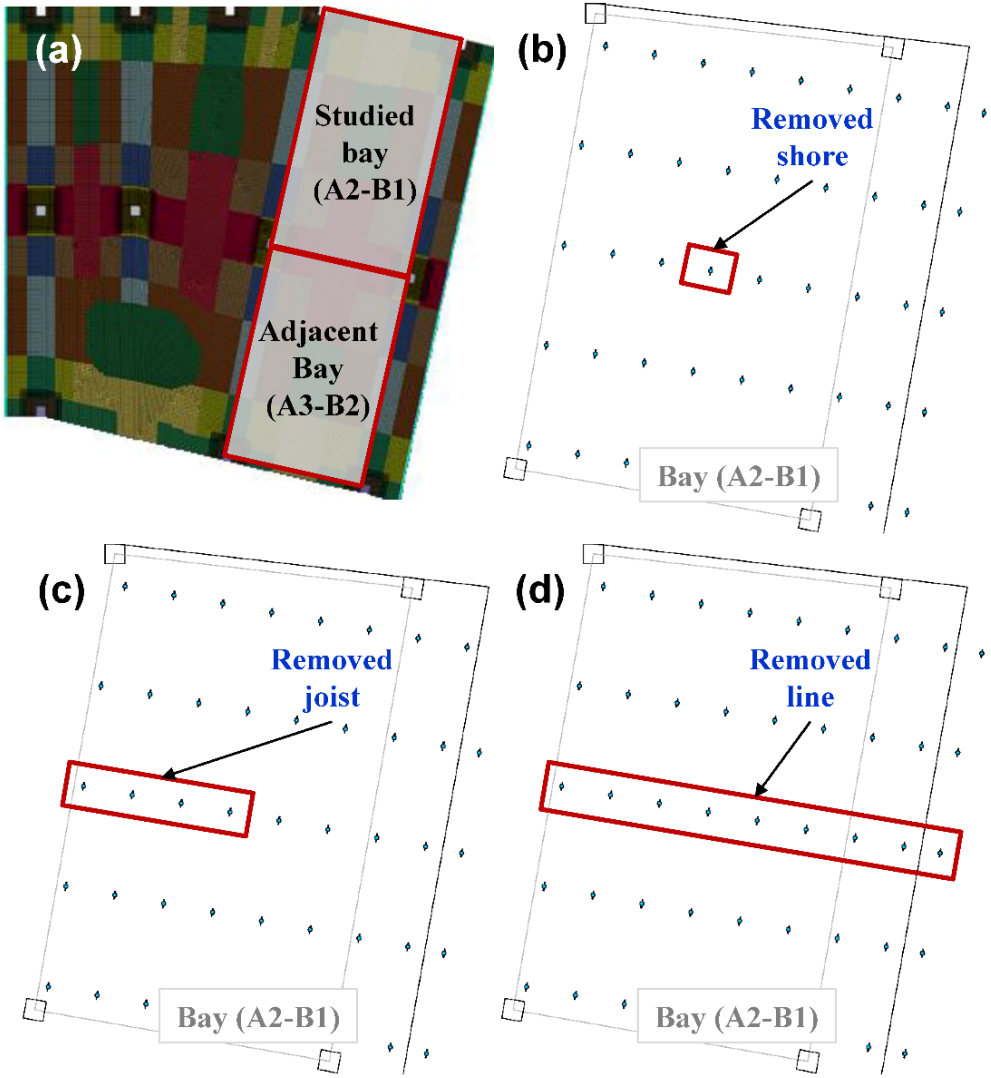
Building and shoring system

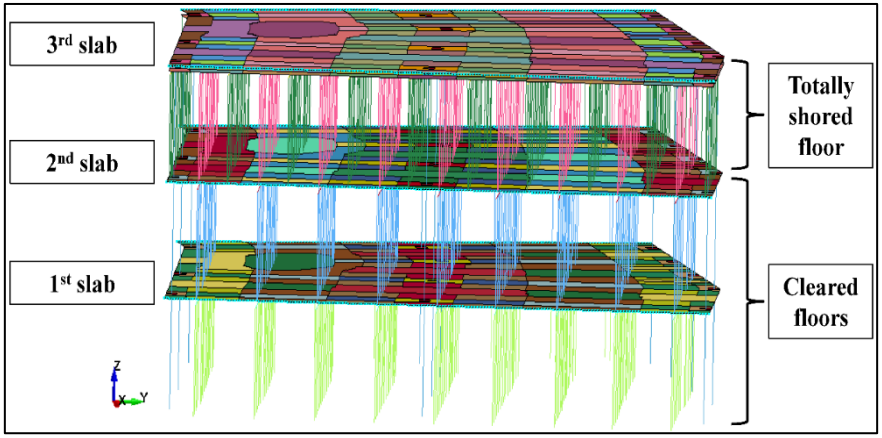




3. STUDY CARRIED OUT

FEM and failure scenarios



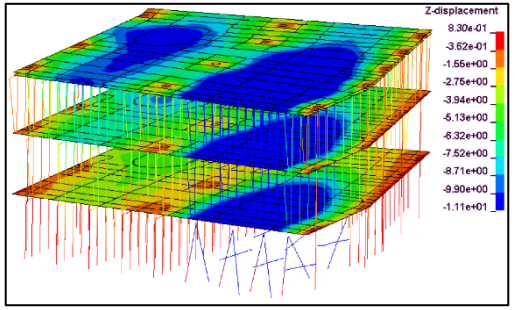


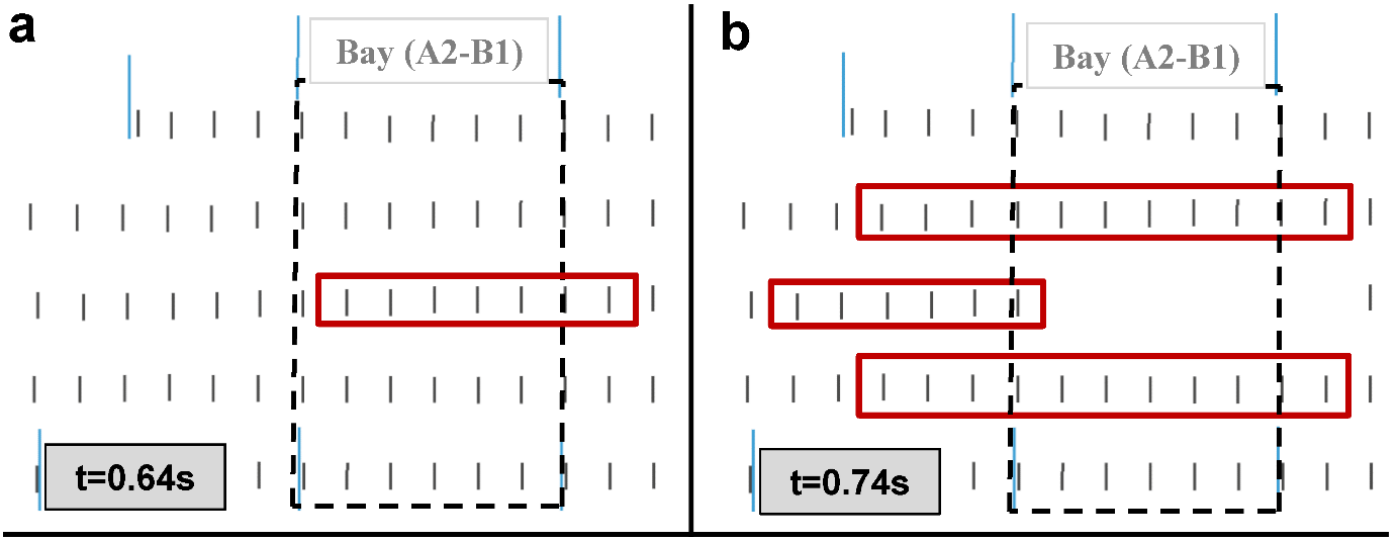
LS-DYNA©

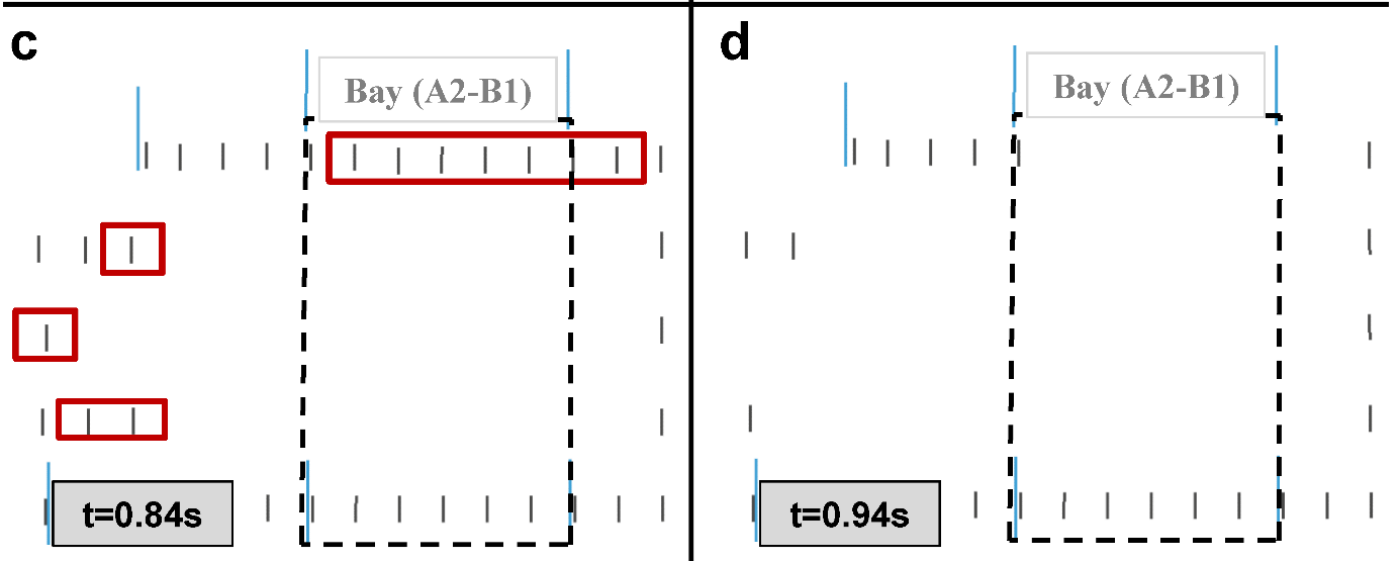
Progressive collapse of the shoring system

3. STUDY CARRIED OUT

4th scenario (incorrect selection of shores)



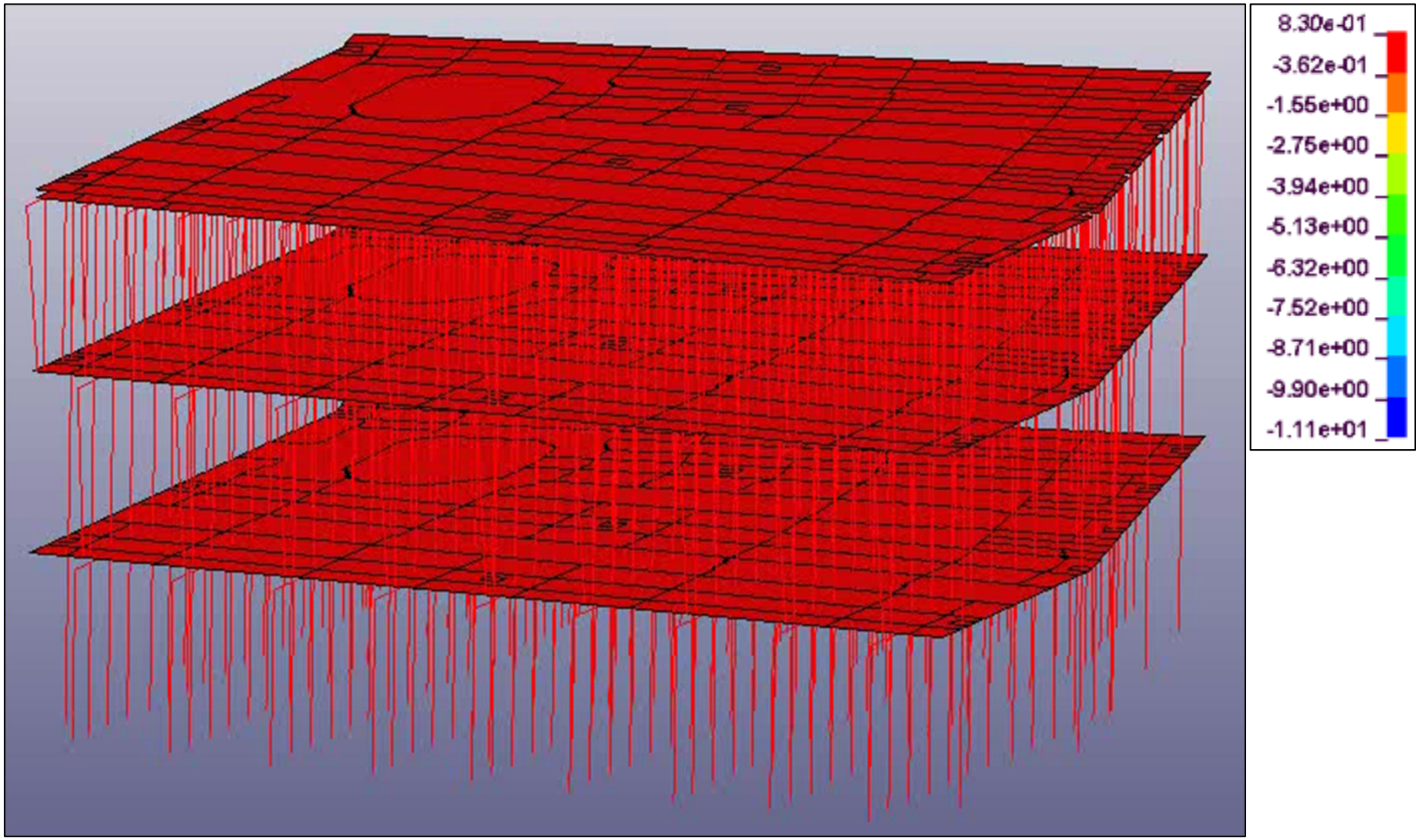




3. STUDY CARRIED OUT

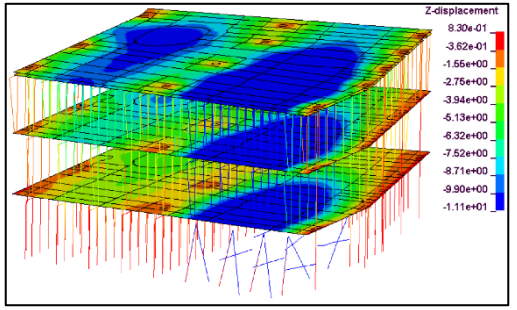
4th scenario (incorrect selection of shores)

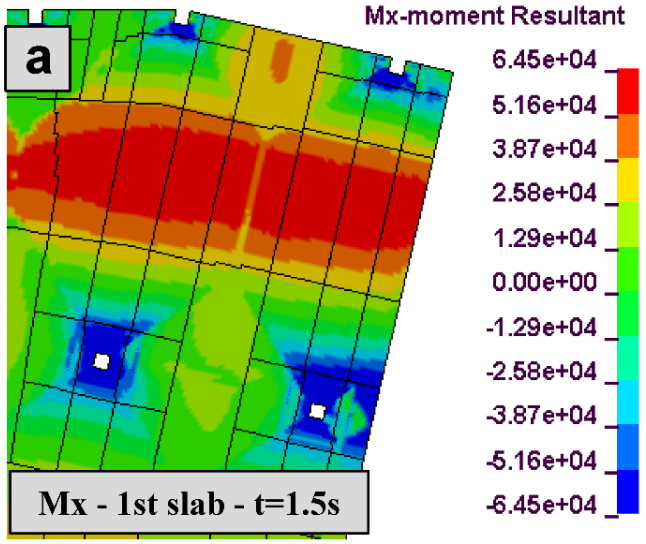
t = 2 seconds
Failure at 0.66s

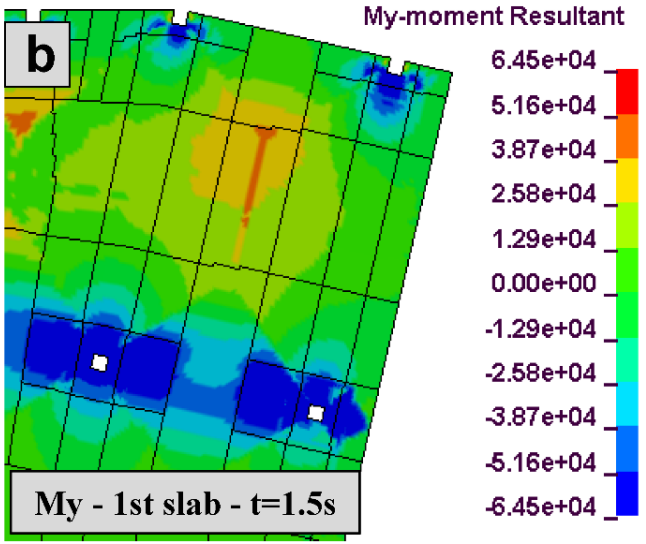


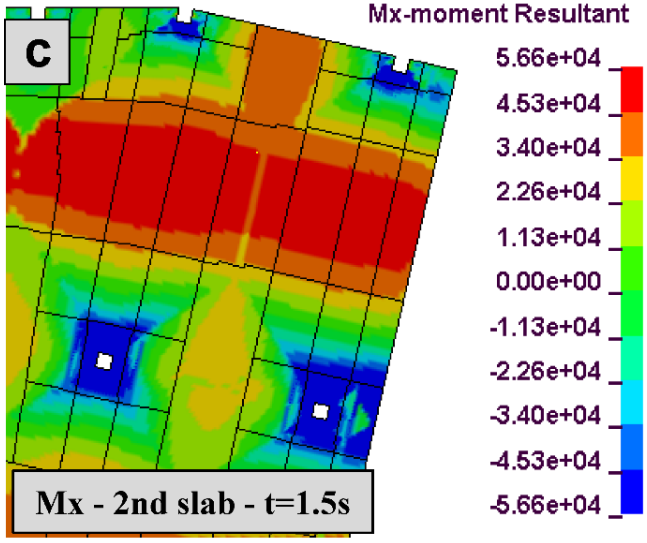
3. STUDY CARRIED OUT

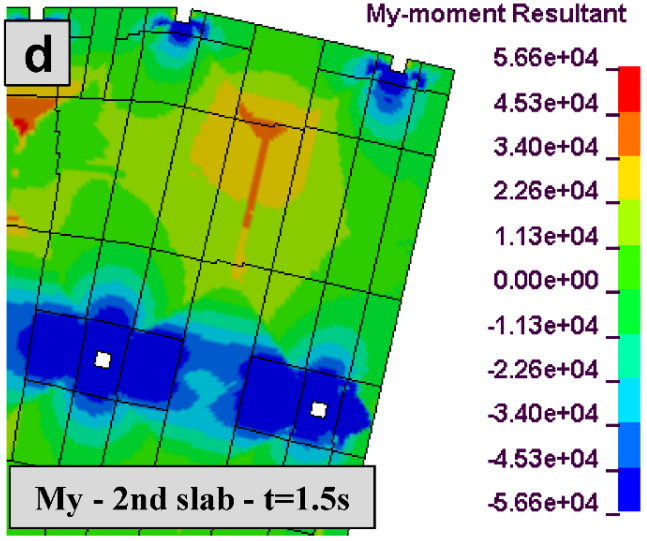
4th scenario (incorrect selection of shores)









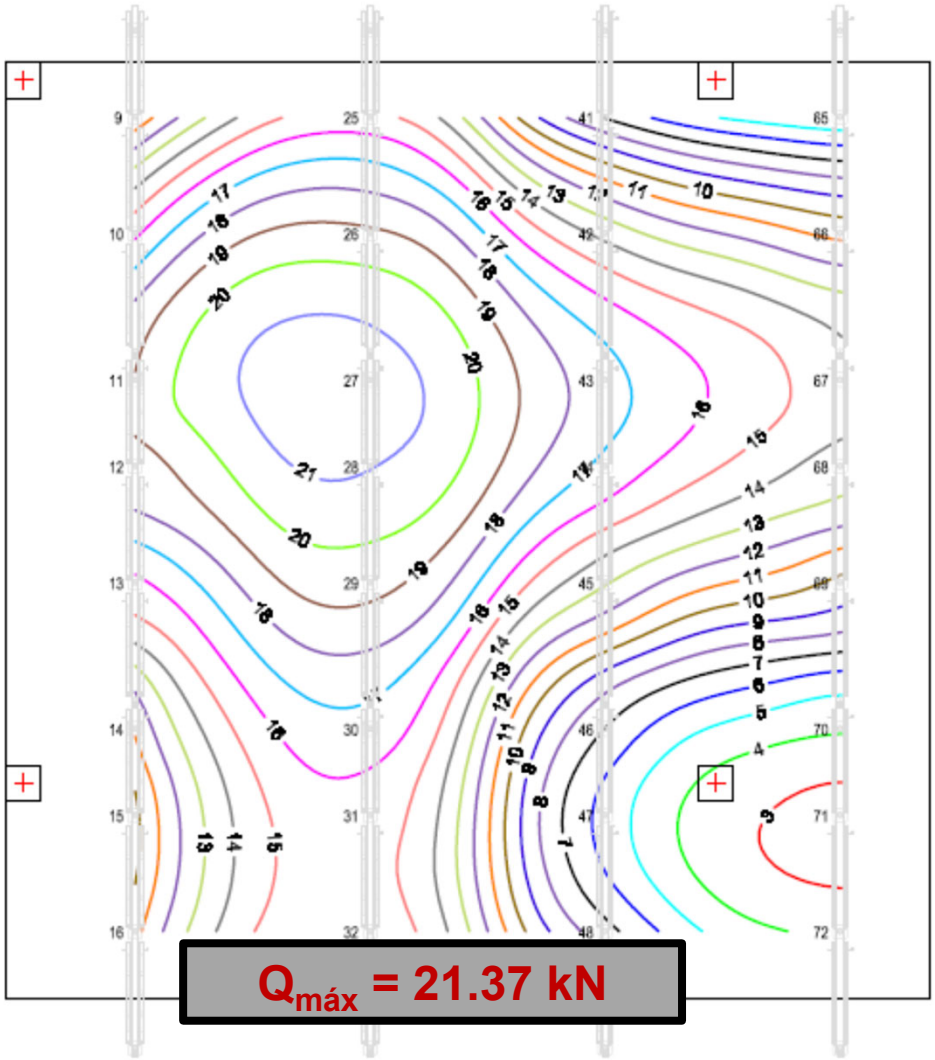


No collapse of the RC structure

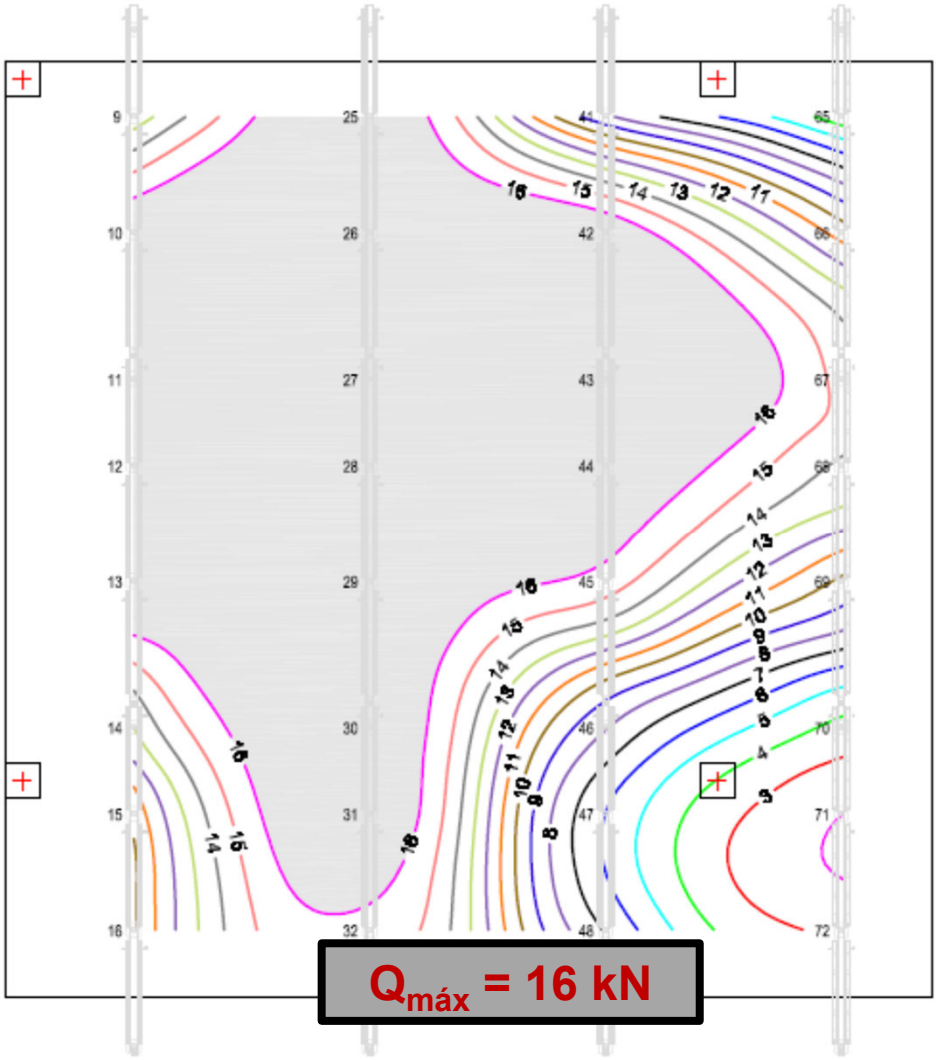
Significant damage:

- **Durability**
- **Serviceability conditions**
- **Short and Long-Term behaviour**

4. DEVICE (LOAD LIMITER)

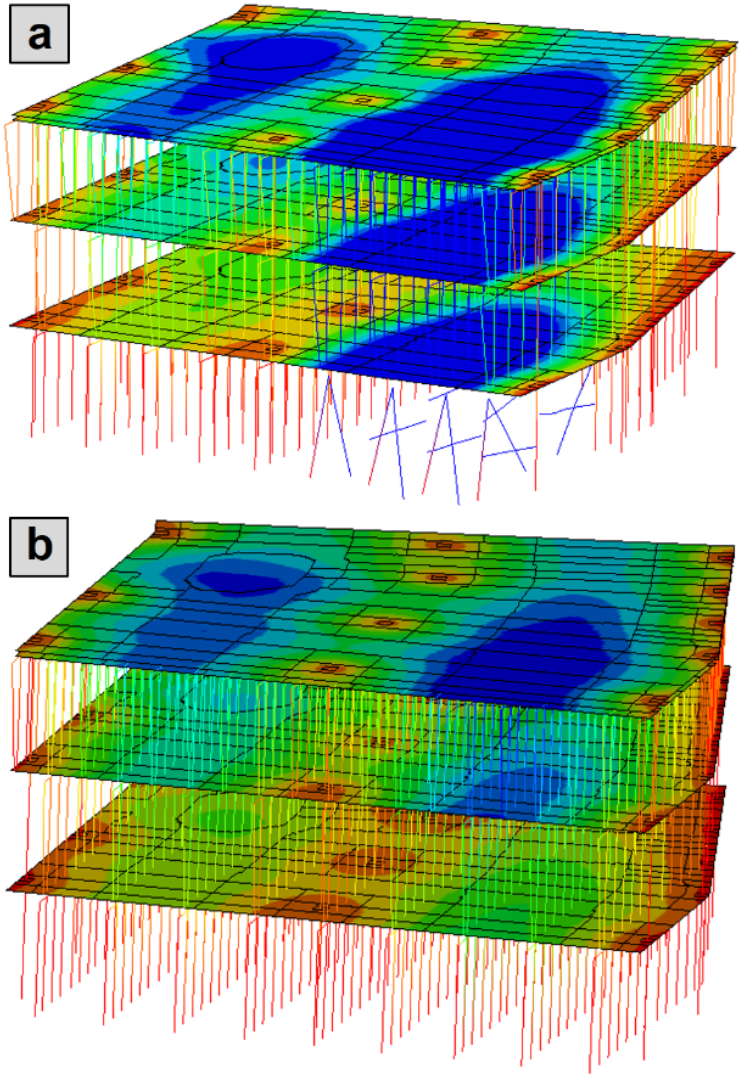


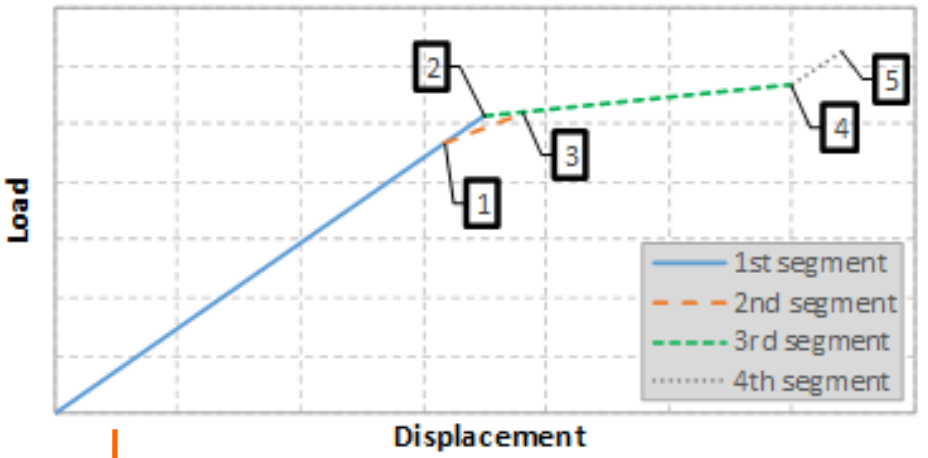
$Q_{máx}$ = 21.37 kN



$Q_{máx}$ = 16 kN

4. DEVICE (LOAD LIMITER)





5. CONCLUSIONS

High-probability / low-consequence scenarios

No progressive collapse of the RC structure, but severe damage

Scenarios with serious damage → Safety assessment and repair-demolish

Take into account:

- **Construction process when designing**
- **Accurate and validated calculation methods to estimate load transmission between slabs and shores**
- **Correct RC construction procedures. Avoid stability issues during temporary support situations**

Mitigation techniques to reduce the risk of progressive collapse or serious damage → Load limiters

THANKS FOR YOUR ATTENTION

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LiC