decivil universidade de aveiro
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EN1993-1-2: BUCKLING LENGTHS OF COLUMNS OF UNBRACED FRAMES UNDER FIRE CONDITIONS

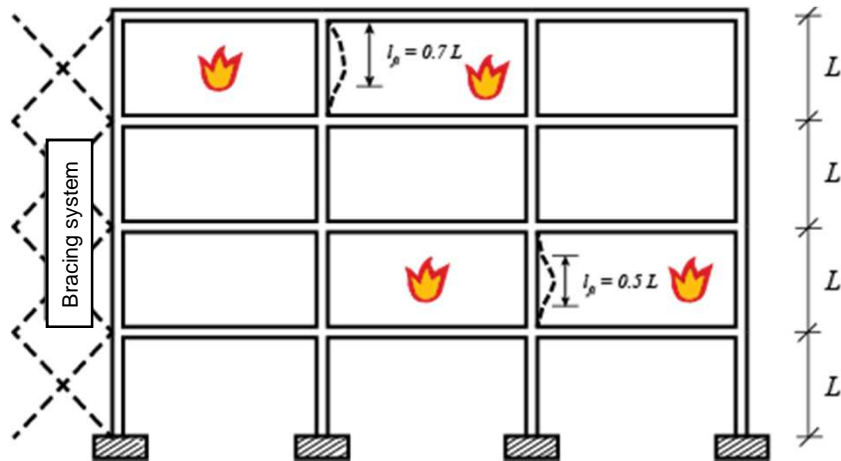**Paulo Vila Real; Carlos Couto; Nuno Lopes**

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"the buckling length l_{fi} of a column for fire design should generally be determined as for normal temperature design"

in the case of a braced frame, in which each storey comprises a separate fire compartment with sufficient fire resistance, it suggests a value of

$l_{fi} = 0.5L$ for the buckling length of a column in an intermediate storey and

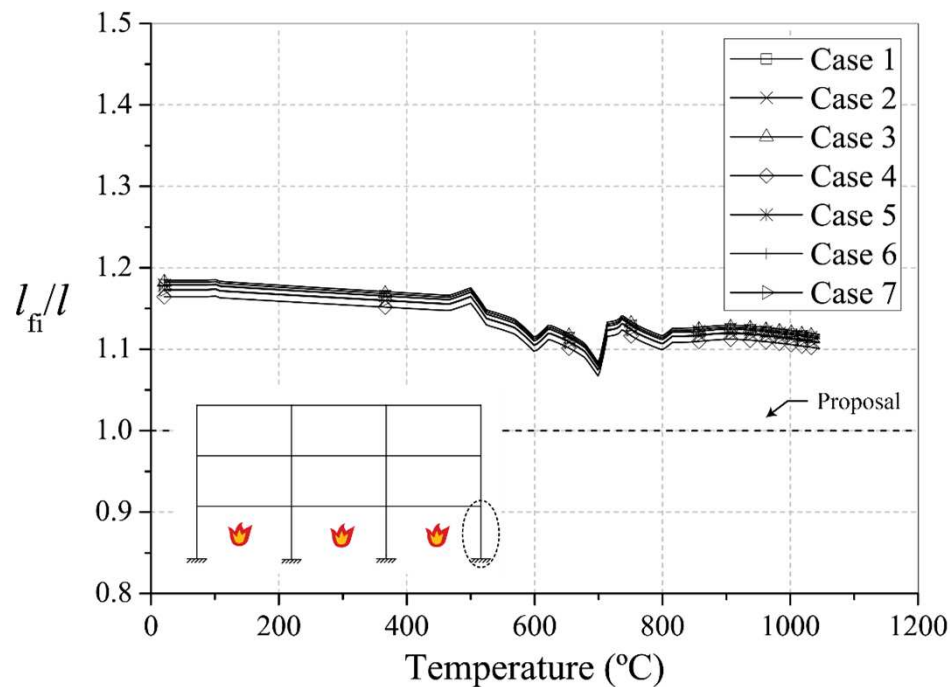$l_{fi} = 0.7L$, for a column in the last storey, where L is the system length on the relevant storey.

Bracing system

$l_{fi} = 0.7 L$

$l_{fi} = 0.5 L$

L

L

L

L

For unbraced frames the EC3 says nothing!

Buckling analysis of a multi-storey building in fire situation

Fully fixed supports

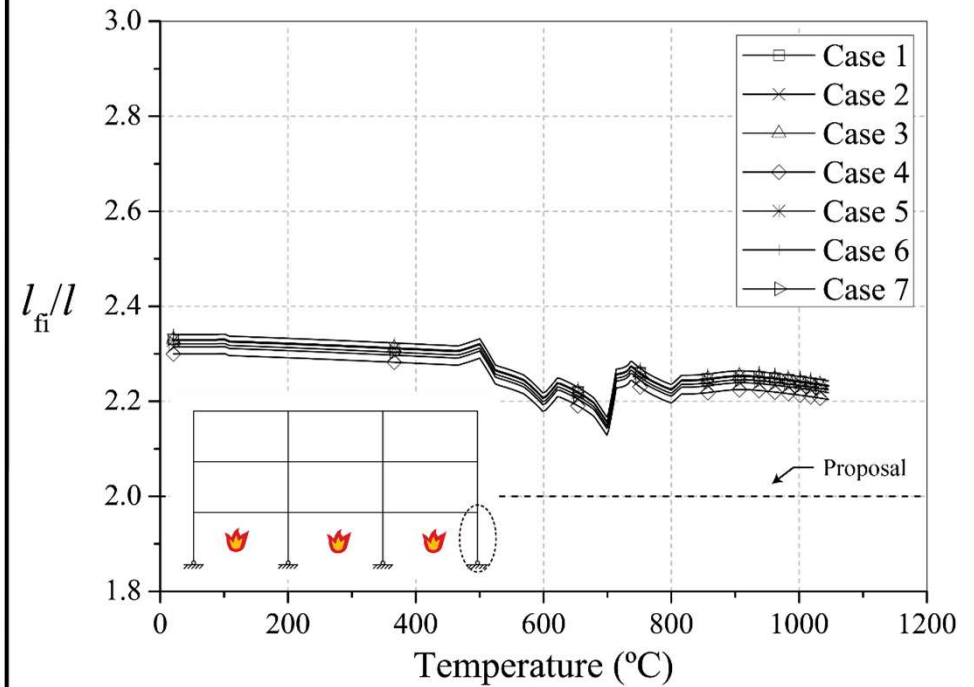**Pinned supports**

New proposal: $l_{fi}/l = 1.0$

New proposal: $l_{fi}/l = 2.0$

Buckling analysis of a multi-storey building in fire situation

Buckling analysis of a multi-storey building in fire situation

Fully fixed supports
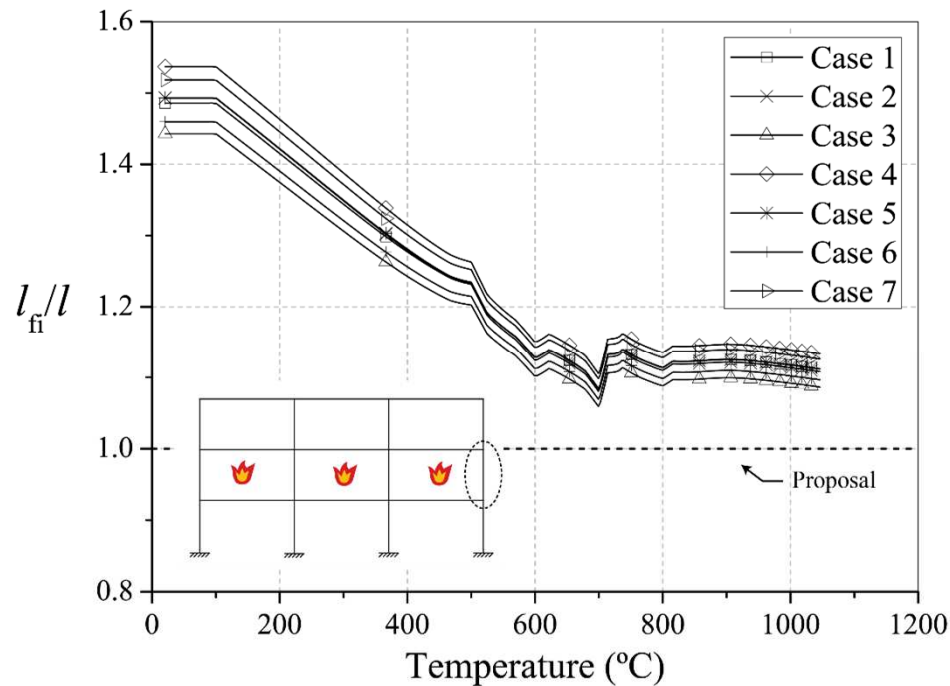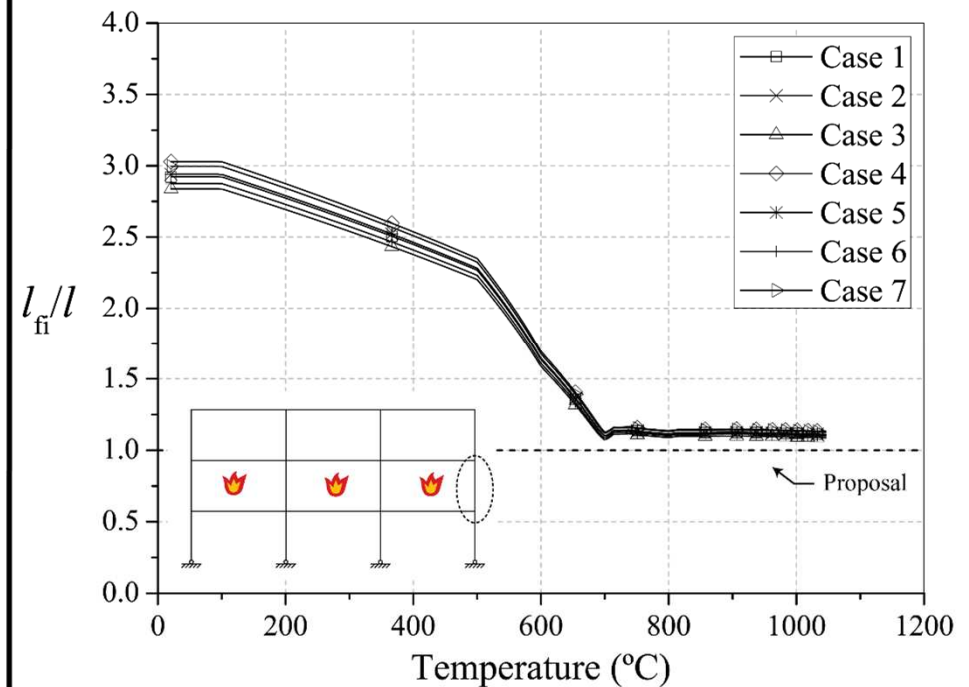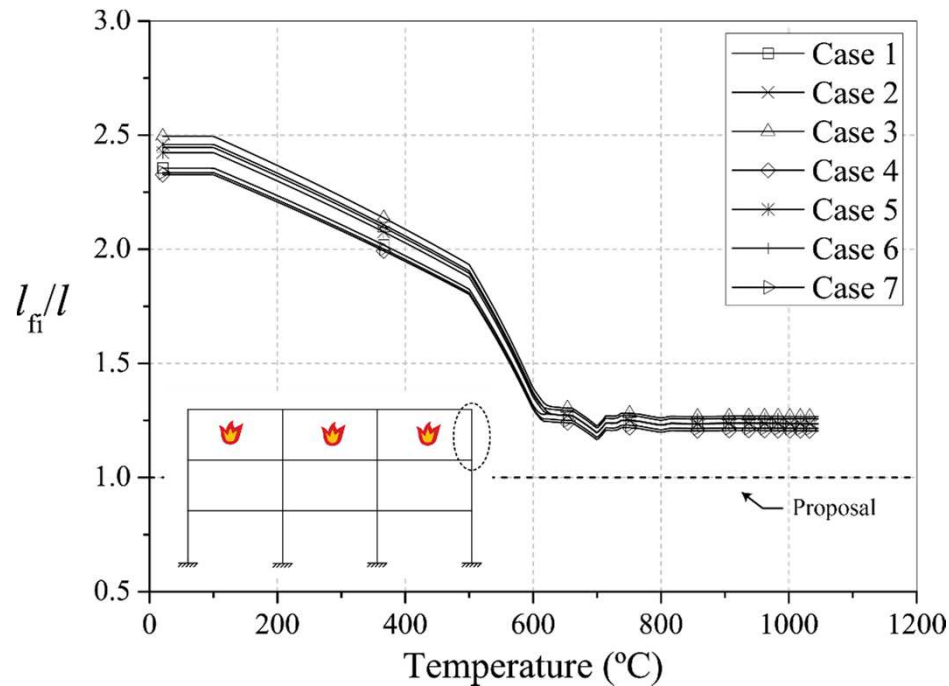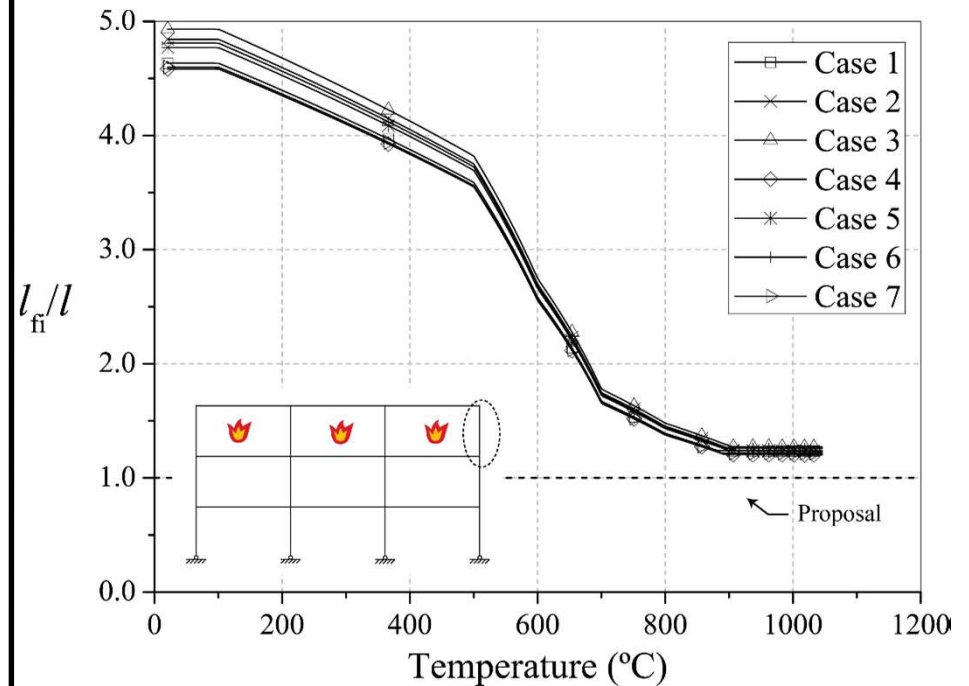
Pinned supports

New proposal: $l_{fi}/l = 1.0$

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EN1993-1-2: Buckling lengths of columns of unbraced frames under fire conditions
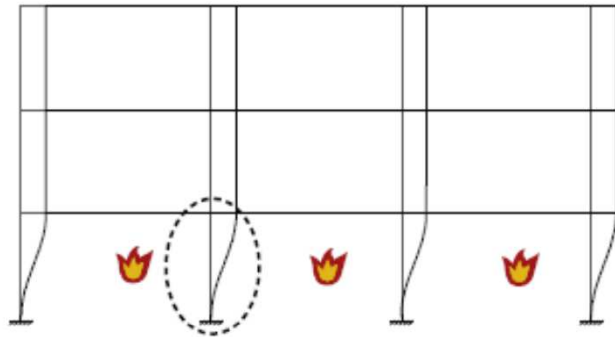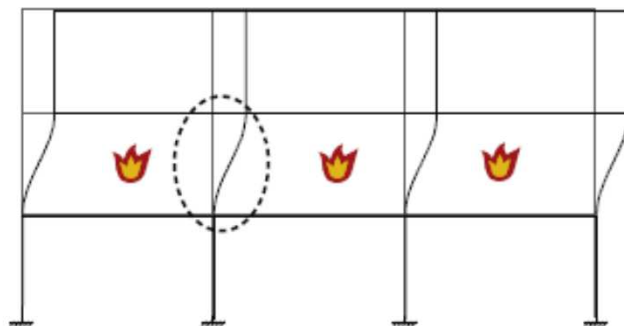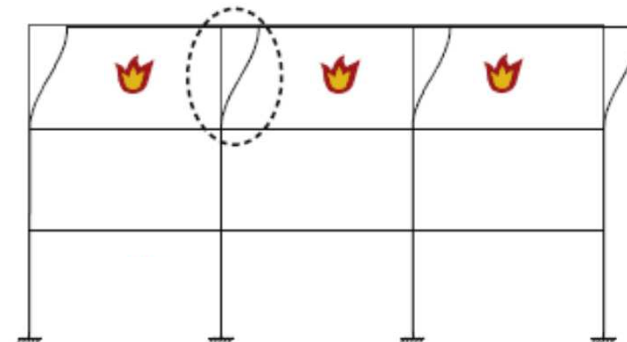
(a) fixed supports, 1st storey columns, buckling length factor: k=1.0
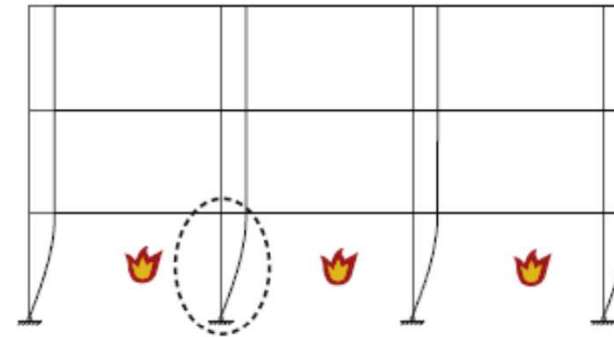
(b) pinned supports, 1st storey columns, buckling length factor: k≥2.0

(c) fixed supports, upper storey columns, buckling length factor: k=1.0

(d) pinned supports, upper storey columns, buckling length factor: k=1.0

For unbraced frames:

Eurocode 3 Part 1.2 does not suggest any values for the buckling lengths.

It is proposed to use: l_{fi}/l = 1.0 as the buckling length for all the columns

except for those in the first storey when the frame has pinned supports

In this case, the buckling length will depend on the restraint level of the remaining structure, being expected to be equal to l_{fi}/l = 2.0 if the restraint level is sufficient to consider a pinned fully fixed (with lateral displacement) condition or greater otherwise.

Note: Further research should be performed regarding this question, but for the structures analysed in the work, the proposed buckling length of l_{fi}/l = 2.0 presented a good approximation.

References:

COUTO, C.; VILA REAL, P.; LOPES, N.; RODRIGUES, J.-P. "Buckling analysis of braced and unbraced steel frames exposed to Fire", Journal Engineering Structures, Elsevier, ISSN: 0141-0296, volume 49, pp. 541–559, doi 10.1016/j.engstruct.2012.11.020, April of **2013**.

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Thank you for your attention

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