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Movement and Tolerance Specification Renfrew Hotel, Glasgow

31st May 2019

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Movement and Tolerance Specification For Renfew Hotel, Glasgow

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Revision	Date	Notes	Prepared By	Checked By	Approved By
P01	11/03/19	First Issue	RC	AH	DC
P02	31/05/19	Second Issue	RC	DC	DC

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3.4.

1. Introduction

This document defines the anticipated and allowable movements and tolerances associated with the primary structure. It is a performance specification for subcontractors' design elements. This specification should be included in the subcontract documentation for all following and coincident trades where there is a direct interface with the primary structure.

For the fit out of other building elements refer to the respective specifications in the contract documents and BS 5606 for general guidance.



2. Allowable Movements

2.1. Vertical Deflections – Superstructure

2.1.1. Deflection of Concrete Floor Beams and Slabs

Total long term deflection including creep to be the lesser of:

Internal spans:

- Span/250 (mm)
- 30mm

Edge spans:

- Span/360 (mm)
- 25mm

Live Load plus the residual creep after installation of finishes or cladding, for all levels, is to be the lesser of:

Internal spans:

- Span/500 (mm)
- 20mm

Edge Span:

- Span/500 (mm)
- 15mm

The creep and shrinkage factors used in the slab/beam design will be calculated in accordance with EC2 (BS EN 1992-1-1:2004).

The creep is dependent on age of loading, ambient conditions and concrete properties. For age of loading reference is to be made to the construction programme.



2.1.2. Differential Deflection of Floor Beams and Slabs

Differential deflection between subsequent floor levels will be limited to $\text{Span}/500$

2.1.2.1 Deflection Plots

Should deflection plot be provided, it should be noted that they are theoretical and only indicative. Several factors affect the performance of the slab. These include compaction, curing, weather, stripping times, back propping, early age loading etc. For this reason, an additional deflection equivalent to 30% should be added over and above the figures in the plots. Pile settlement and frame shrinkage are separate

2.1.3. Transfer Beam Deflections

Total long term deflection including creep to be the lesser of:

- $\text{Span}/360$

- 30mm

Live load plus the residual creep after installation of finishes for all other levels:

- $\text{Span}/500$

- 15mm

AND Differential deflection between adjacent supported columns must be limited to $\text{span}/500$.

Note: SPAN in this case means distance between supported columns).

2.1.4. Differential Shortening of Vertical Elements

Differential shortening of vertical column elements should be assumed to be in the range of 1-1.5mm per m height of storey.

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2.1.5. Deflection of Steelwork

Simply supported steelwork:

- Total deflection: $\text{Span}/250$
- Live load deflection: $\text{Span}/360$

Cantilevered steelwork:

- Total deflection: $\text{Span}/125$
- Live load deflection: $\text{Span}/180$

2.1.6. Non-Structural Elements (Head Restraint for Partitions)

An allowance should be made within the design of non-structural elements for differential vertical deflection equal to the greater of $\text{Span}/500$ (mm) or 20mm.

Where vertical joints in non-structural partitions are at an interface with columns and walls see the detail below.

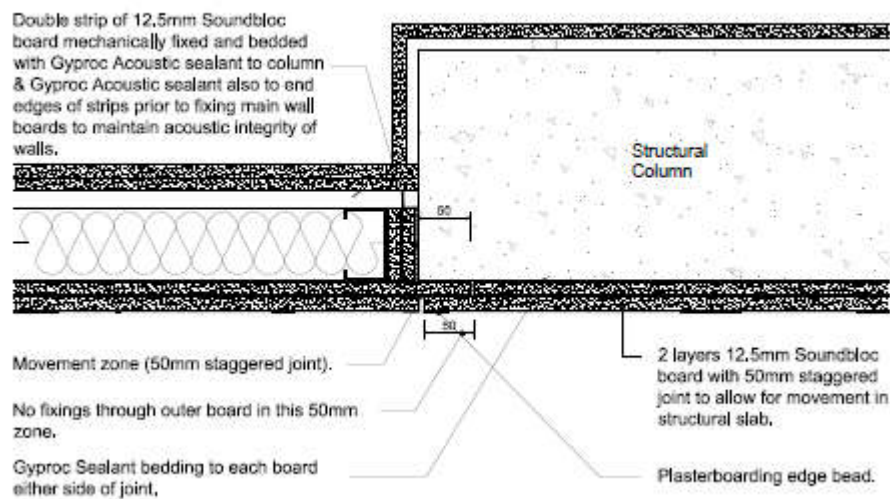


Figure 1: Movement Joint - In Hard Plasterboard Fixing to Concrete Column/Wall (Not to Scale)

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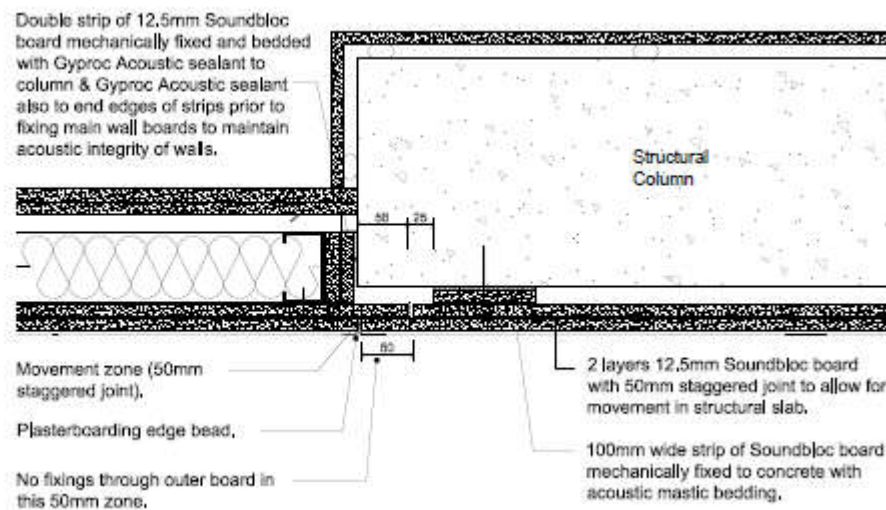


Figure 2: Movement Joint - In Dabbed Plasterboard Fixing to Concrete Column/Wall (Not to Scale)

2. 2. Vertical Deflections – Foundations

2.2.1. Piled Foundations

Total pile settlement is to be limited to 10mm under 1.0 x service loads and 15mm under 1.5 x service loads.

2.2.2. Differential Settlement of Piles

Differential settlement of piles to be limited to distance between piles or pilecaps/500 or 15mm whichever is lesser.

2. 3. Horizontal – Superstructure

2.3.1. Lateral Deflection Due To Wind/Notional Loading

Lateral deflection under wind loading to be less than total height/500.

2.3.2. Lateral Inter Storey Sway

The lateral inter-storey sway, that is the horizontal movement between floors, is to be limited to storey height/500.

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2.3.3. Non-Structural Elements – Lateral Deflection

The total horizontal deflection of non-structural elements will be limited to height/200 for cladding and glazing, and height/300 for brickwork. Horizontal deflection of raking cladding/glazing is to be limited to height/300.

Specific requirements of the cladding system are to be advised by the supplier if more onerous than the above.

Joints in the external cladding to be defined by Architects/subcontractor. For external blockwork, joints should not exceed 6m, and 12m for brickwork.

Vertical movement joints should be provided in masonry walls to accommodate horizontal movement due to variations in the temperature and moisture content of the masonry units.

Where movement joints are located in separating walls, party walls or compartment walls, the reduction in the efficiency of the wall as an insulator of sound, or as a fire barrier, should be taken into consideration.

2. 4. Cladding Design Requirements

2.4.1. Thermal Expansion

Cladding Sub-contractors to consider thermal expansion – refer to CWCT technical note 56.

2.4.2. Cladding Design

All cladding systems must accommodate a post cladding differential deflection of span/500 in addition to mullion thermal expansion and frame shrinkage.

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3.0 Allowable Tolerances

3.1 Concrete Tolerances

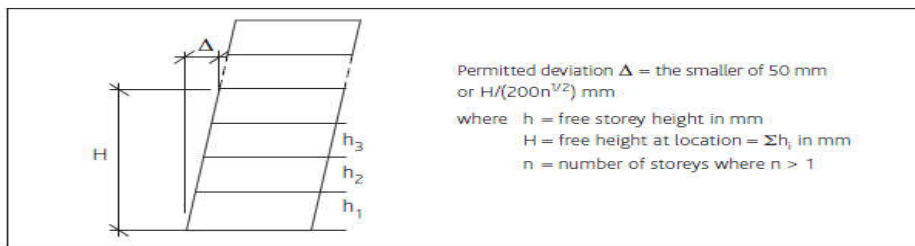
Unless otherwise specified, all concrete is to be installed to the tolerances specified in Section 7 of the National Structural Concrete Specification 4th Edition (relevant extracts are shown following).

Individual Elements (Cl. 10.1.6):

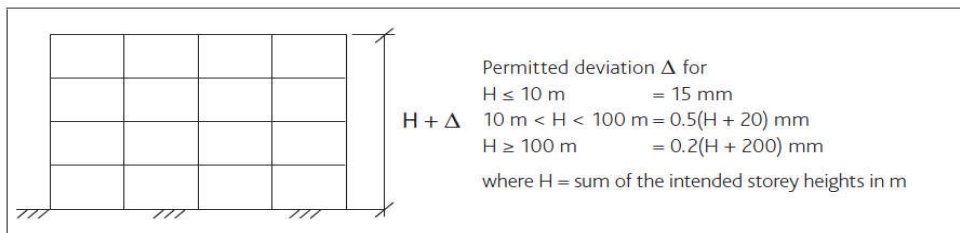
The tolerance for individual elements is $\pm 20\text{mm}$. The deviation or sum of any deviations of any individual element must not exceed the overall building structure tolerance stated below.

Overall Structure (Cl. 10.2):

Inclination – The location of any column, wall or edge floor, at any storey level, from any vertical plane through its intended design centre at base level in a multi-storey structure:



Level of floors measured relative to the intended design level at the reference level:



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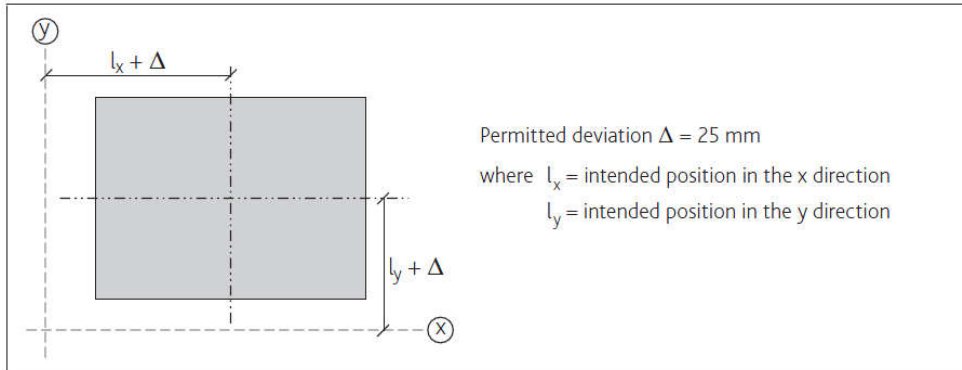
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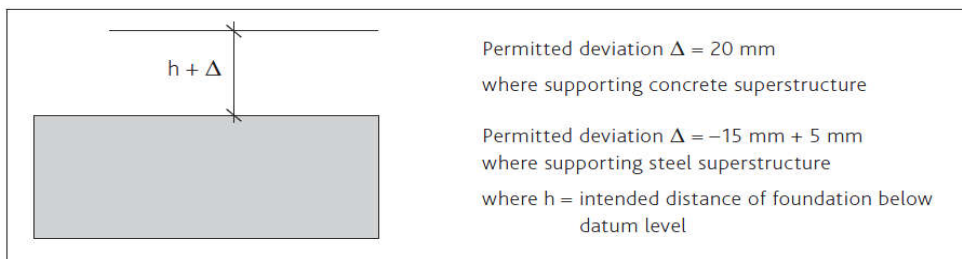
Base Support, Foundations (Cl. 10.3):

These include direct foundations and pile caps, etc. but not deep foundations such as piles.

Plan section:



Vertical Section - Position in the vertical direction of a base support relative to the intended design position:



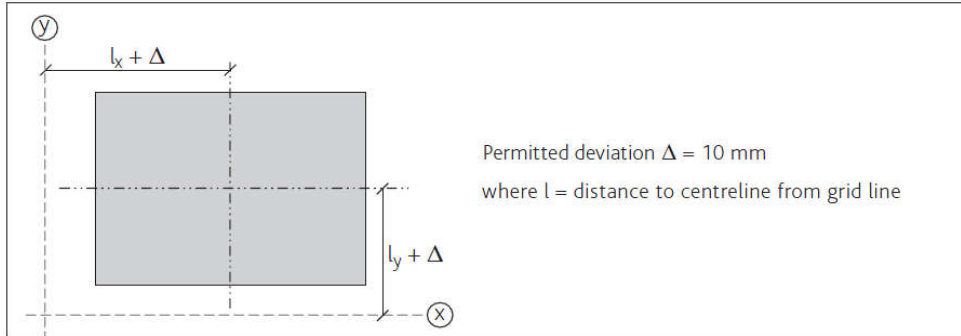
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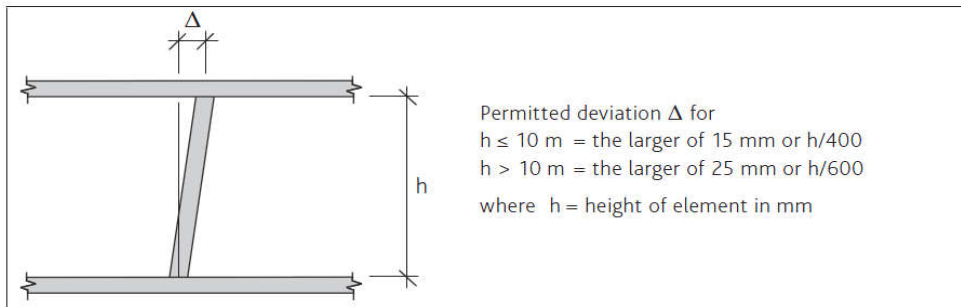


Columns and Walls (Cl. 10.5):

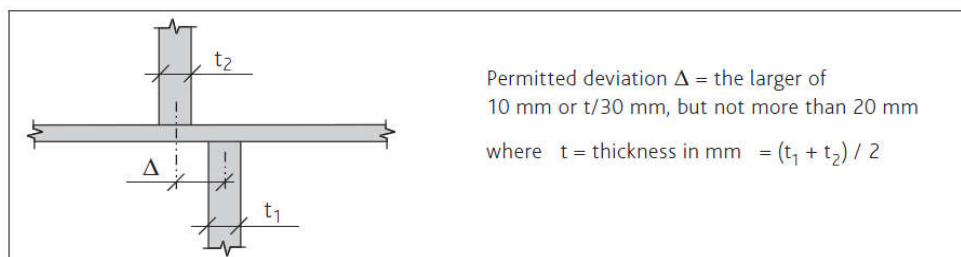
Plan: The position of the element centre line relative to, at base level the intended design position, and at any upper level the actual location of the element at the level below:



Verticality by storey of the structure - Inclination of a column or wall at any level:



Deviation between centrelines of elements meeting at a floor level:

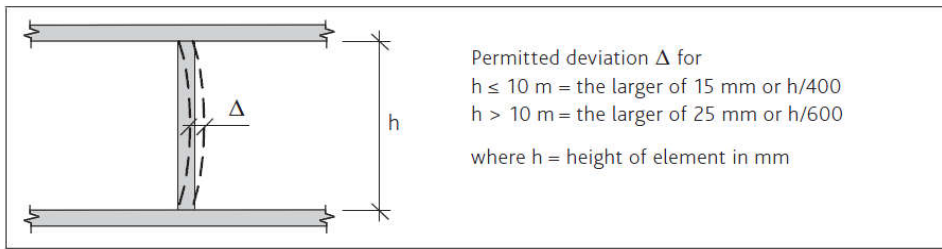


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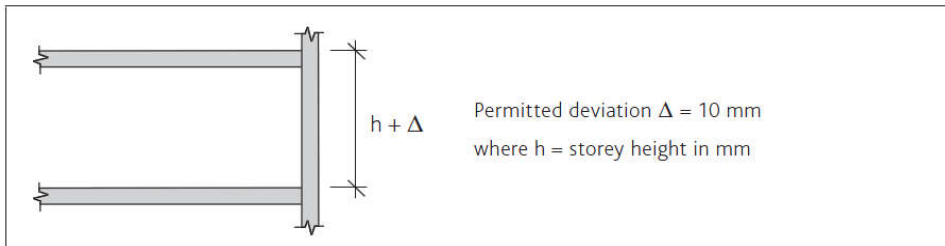
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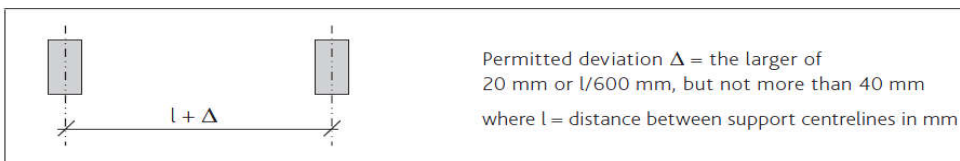
Curvature between adjacent floors of an element:



Level per storey of structure – level of adjacent floors at supports:



Distance between adjacent columns and walls:



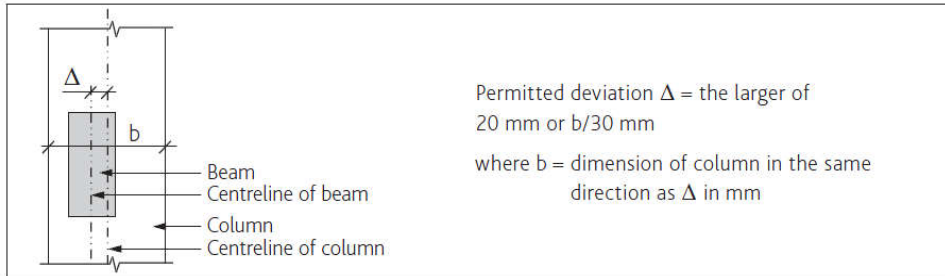
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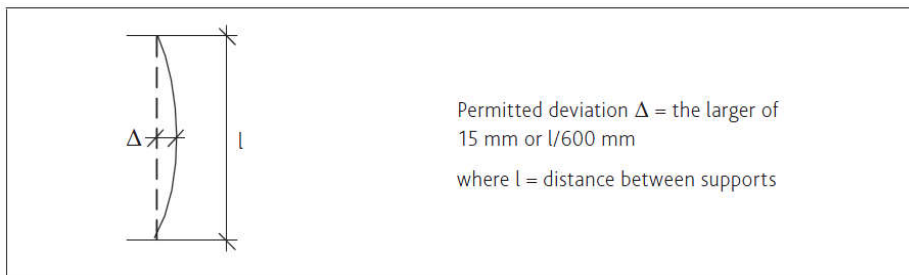


Beam and Slab Elements (Cl. 10.6):

Beam to Column Connection (measured relative to the column):



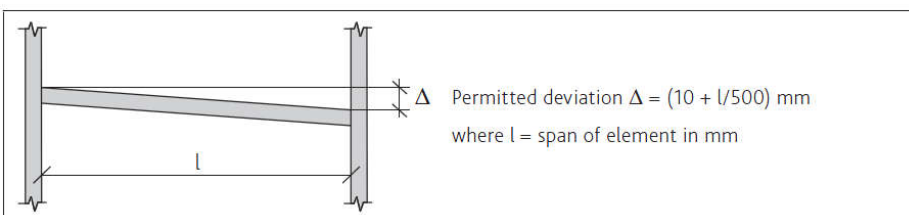
Horizontal Straightness of beams:



Difference between adjacent beams (measured at corresponding points):



Inclination of beam or slab – difference in level at corresponding points in any direction:

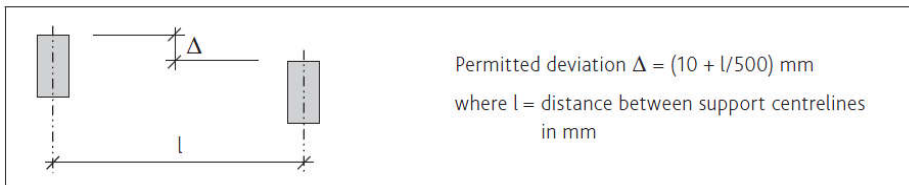


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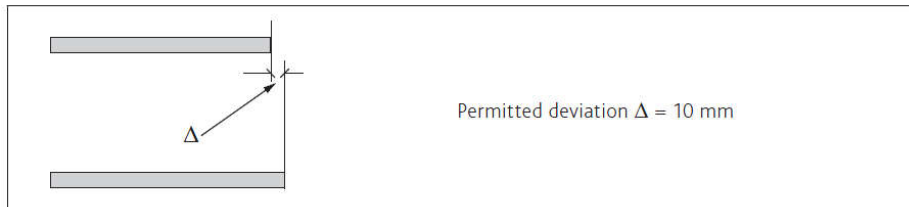
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Level of adjacent beams (measured at corresponding points):

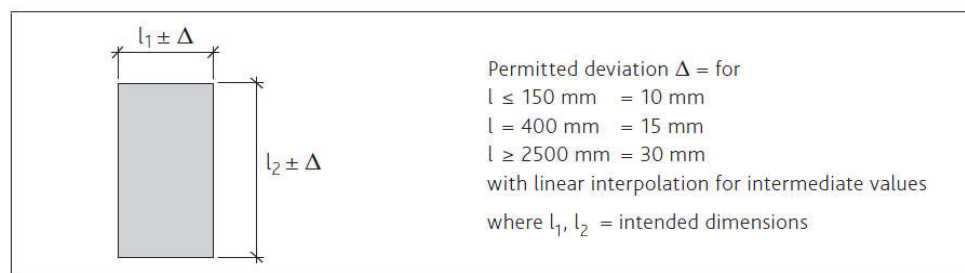


Position of Slab Edge (relative to actual edge of floor below):

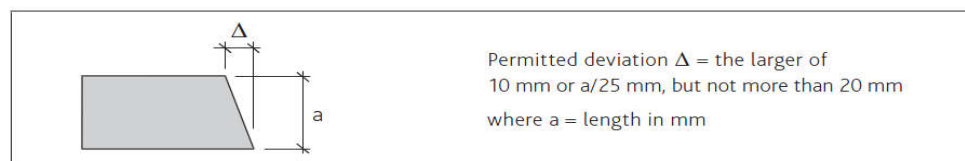


Section of Elements (Cl. 10.7):

Cross-section of elements (beams, slabs, columns etc):

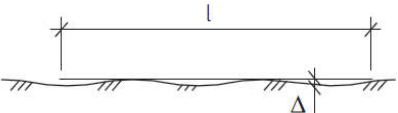


Cross-sectional Squareness of elements (beams, slabs, columns etc):



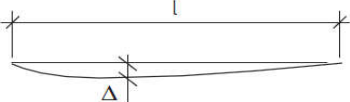
Surface Straightness (Cl. 10.9):

Flatness:



- Basic unformed surface (Cl. 8.6.2.1)
Permitted global deviation $\Delta = 12 \text{ mm}$
Permitted local deviation $\Delta = 5 \text{ mm}$
- Ordinary unformed surface (Cl. 8.6.2.2)
Permitted global deviation $\Delta = 9 \text{ mm}$
Permitted local deviation $\Delta = 3 \text{ mm}$
- Ordinary surfaces (Cl. 8.6.1.2)
Permitted global deviation $\Delta = 9 \text{ mm}$
Permitted local deviation $\Delta = 5 \text{ mm}$
- Plain surfaces (Cl. 8.6.1.3)
Permitted global deviation $\Delta = 9 \text{ mm}$
Permitted local deviation $\Delta = 3 \text{ mm}$

Edge Straightness of floor slabs or elements:



Permitted deviation Δ for

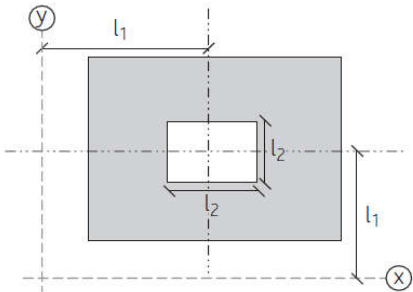
$l < 1 \text{ m} = 8 \text{ mm}$

$l > 1 \text{ m} = 8 \text{ mm/m}$, but no greater than 20 mm

where l = length of edge

Holes (Cl. 10.10):

Size and location relative to design position:



- Position
Permitted deviation $\Delta_1 = 10 \text{ mm}$
where l_1 = intended distance to centre line
- Size
Permitted deviation $\Delta_2 =$
 $l_2 \leq 150 \text{ mm} = 6 \text{ mm}$
 $l_2 = 400 \text{ mm} = 15 \text{ mm}$
 $l_2 \geq 2500 \text{ mm} = 30 \text{ mm}$
 with linear interpolation for intermediate values
 where l_2 = intended dimension

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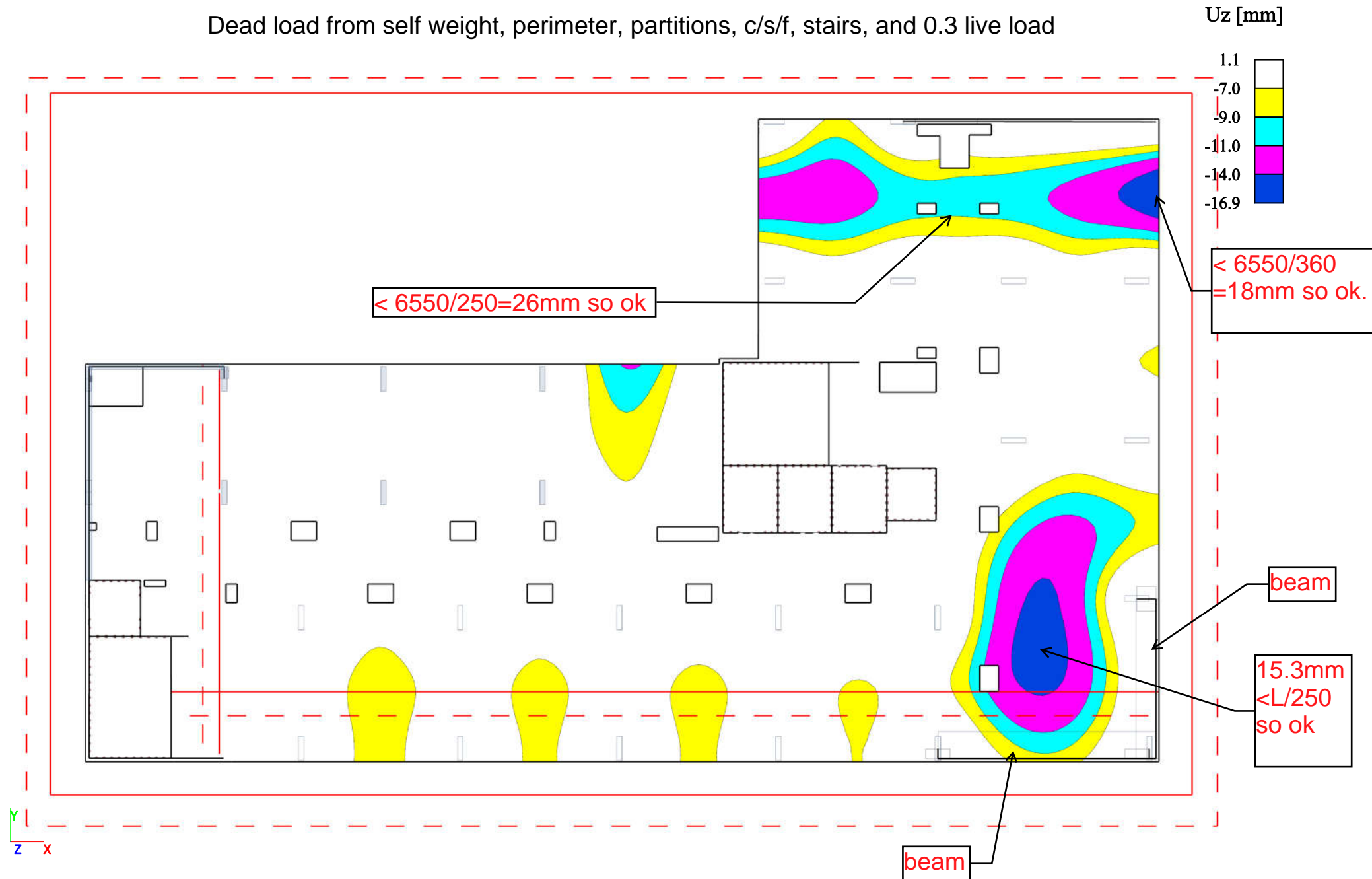
4.0 Appendices – Slab Deflection Plots

4.1 Typical Even Upper Floor (Level 4/6/8)



Level 4 slab Total Non Linear + Creep

Dead load from self weight, perimeter, partitions, c/s/f, stairs, and 0.3 live load



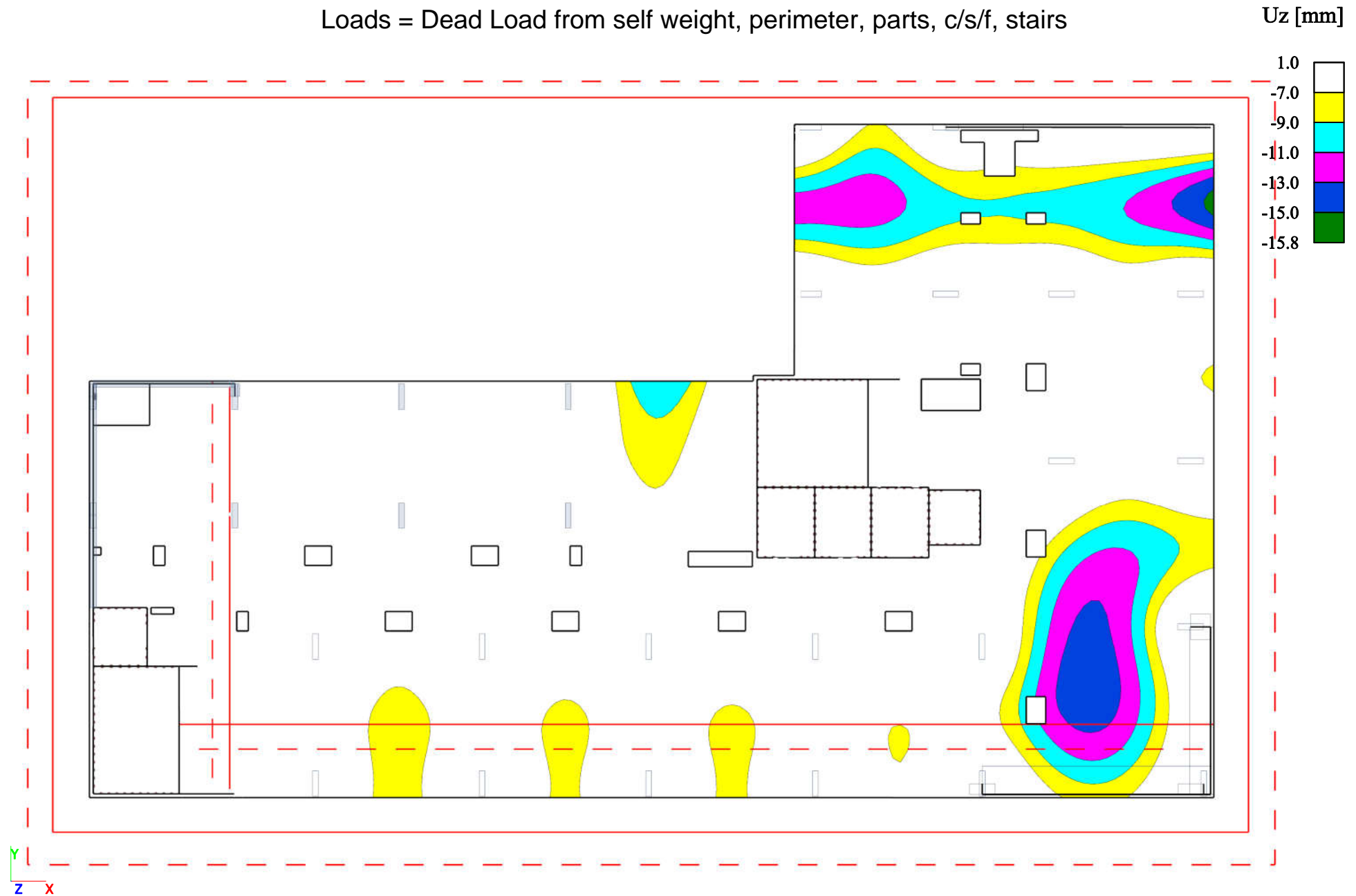
Result : Uz

Project : -

Author : -

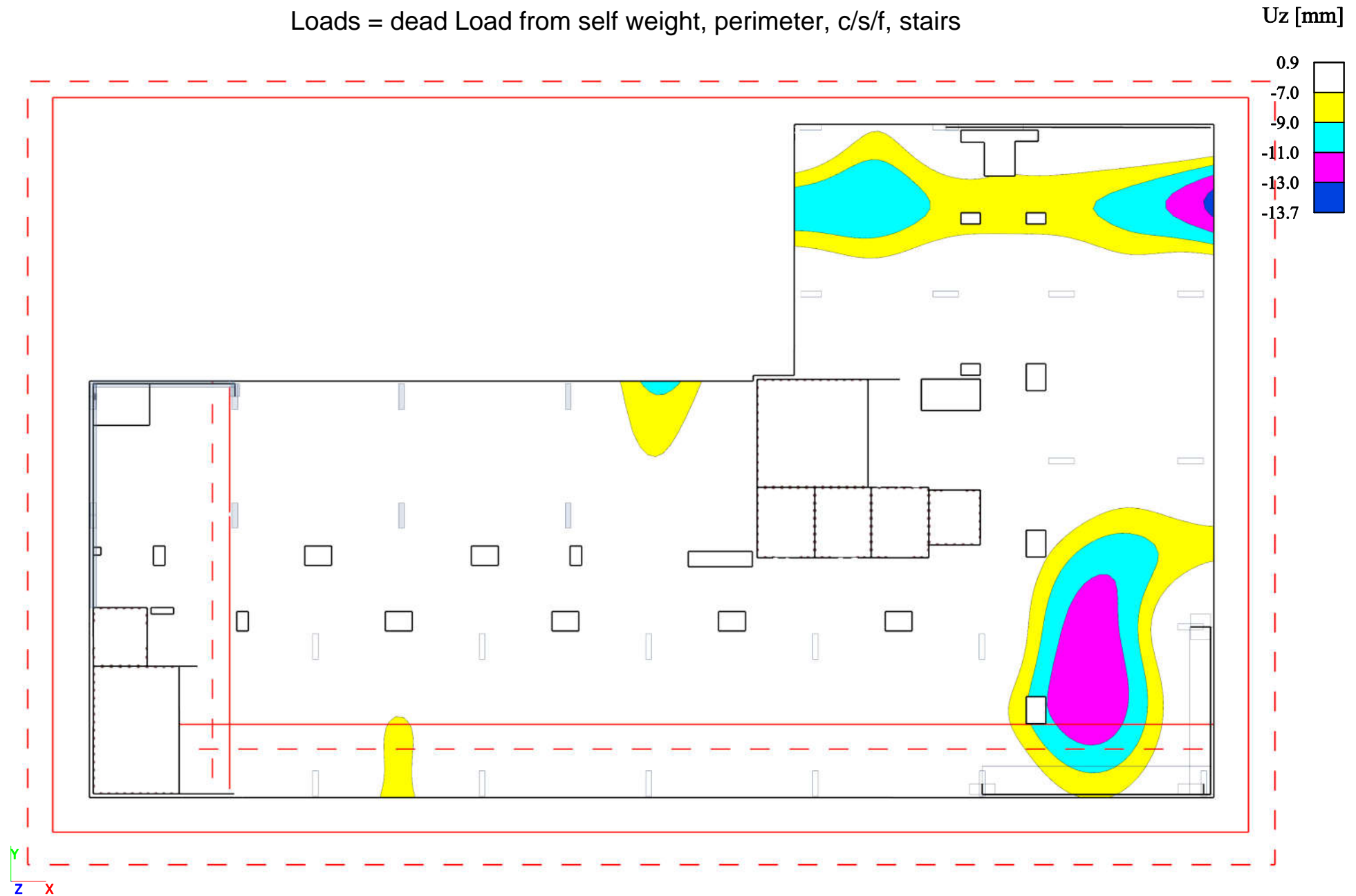
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L4 NL+Creep - post clad/partitions but no LL
Loads = Dead Load from self weight, perimeter, parts, c/s/f, stairs



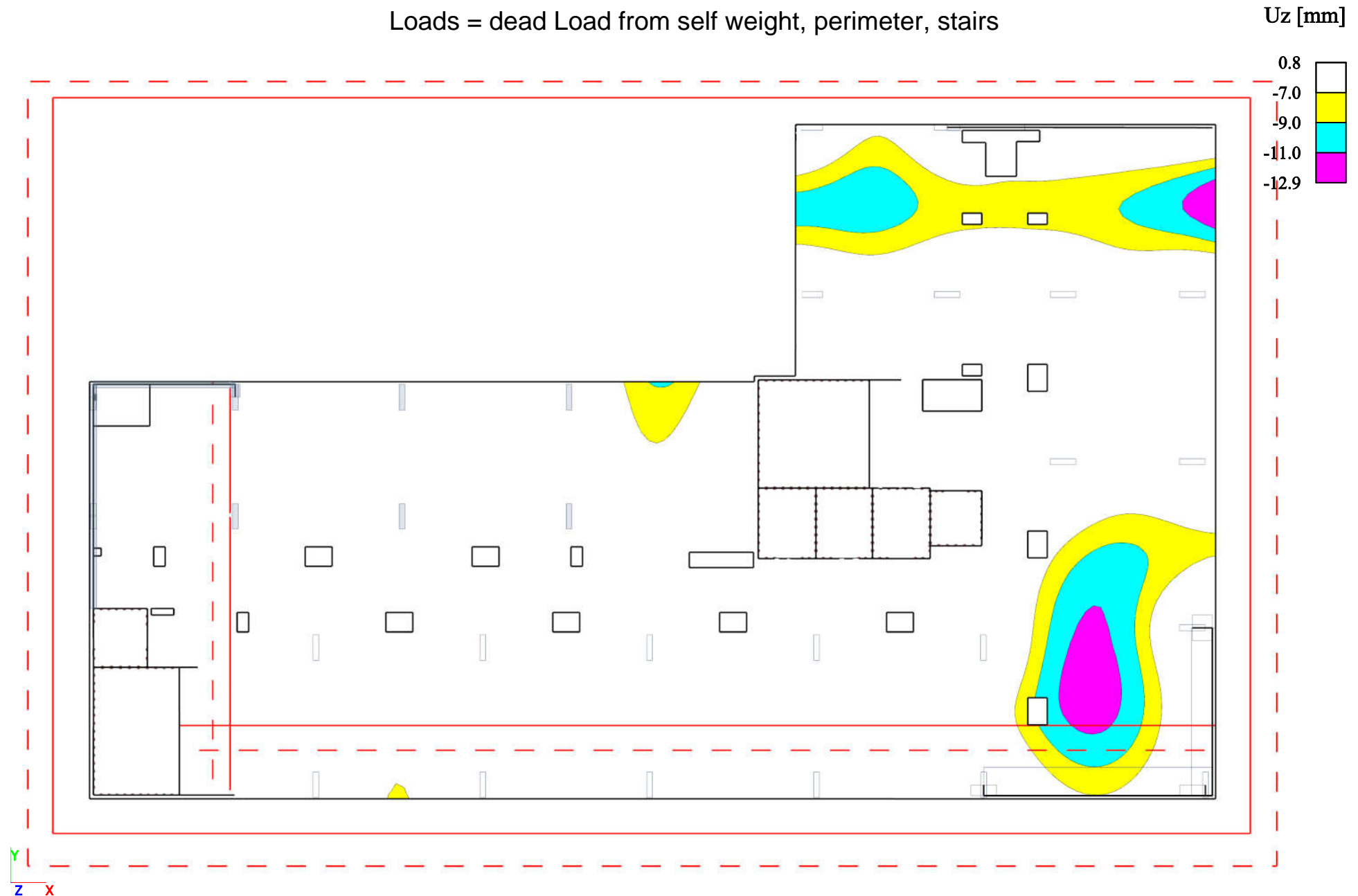
L4 NL+Creep - post cladding & finishes, no partitions

Loads = dead Load from self weight, perimeter, c/s/f, stairs



L4 NL+Creep - post clad pre finishes

Loads = dead Load from self weight, perimeter, stairs

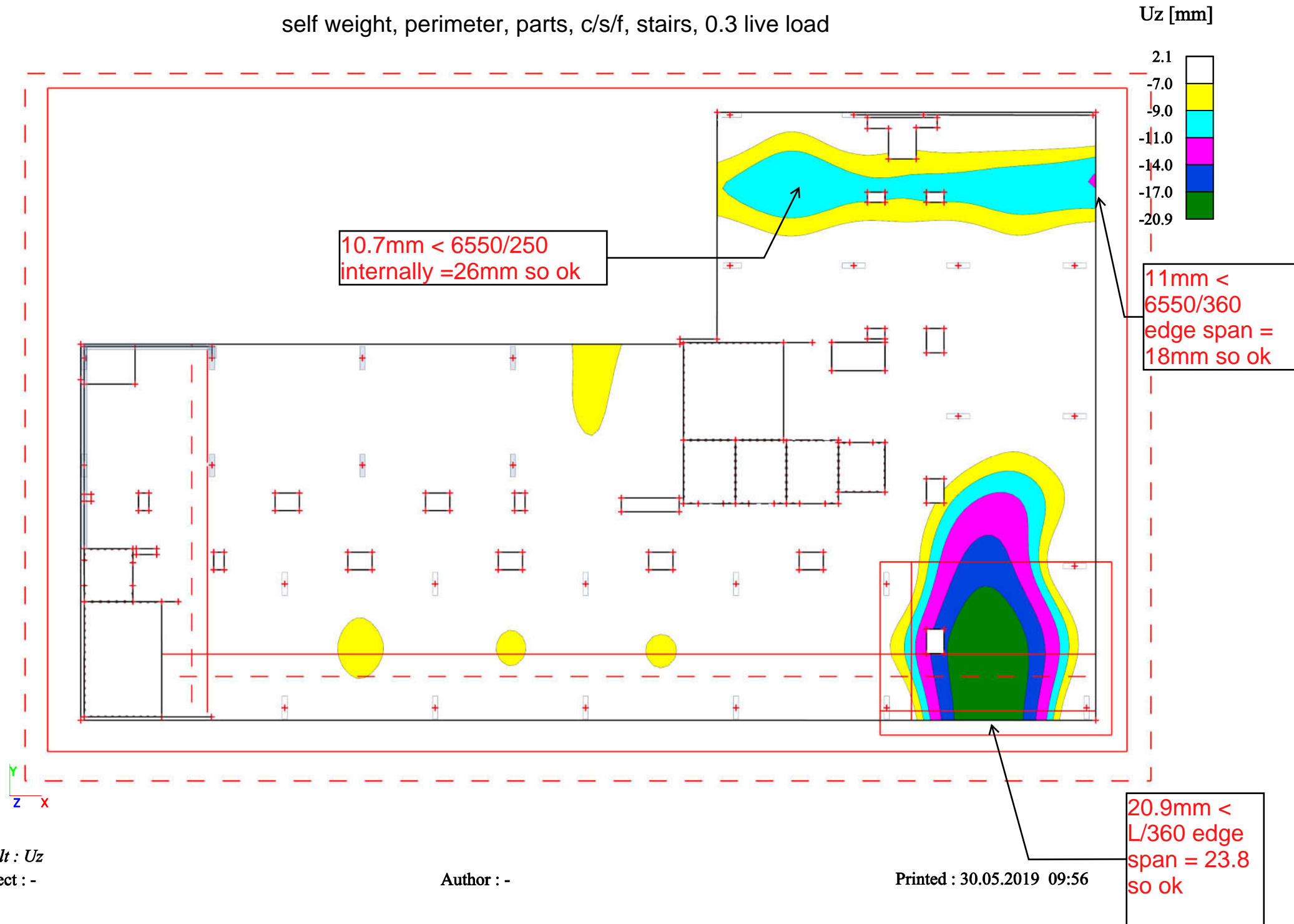


4.2 Typical Odd Upper Floor (Level 3/5/7)



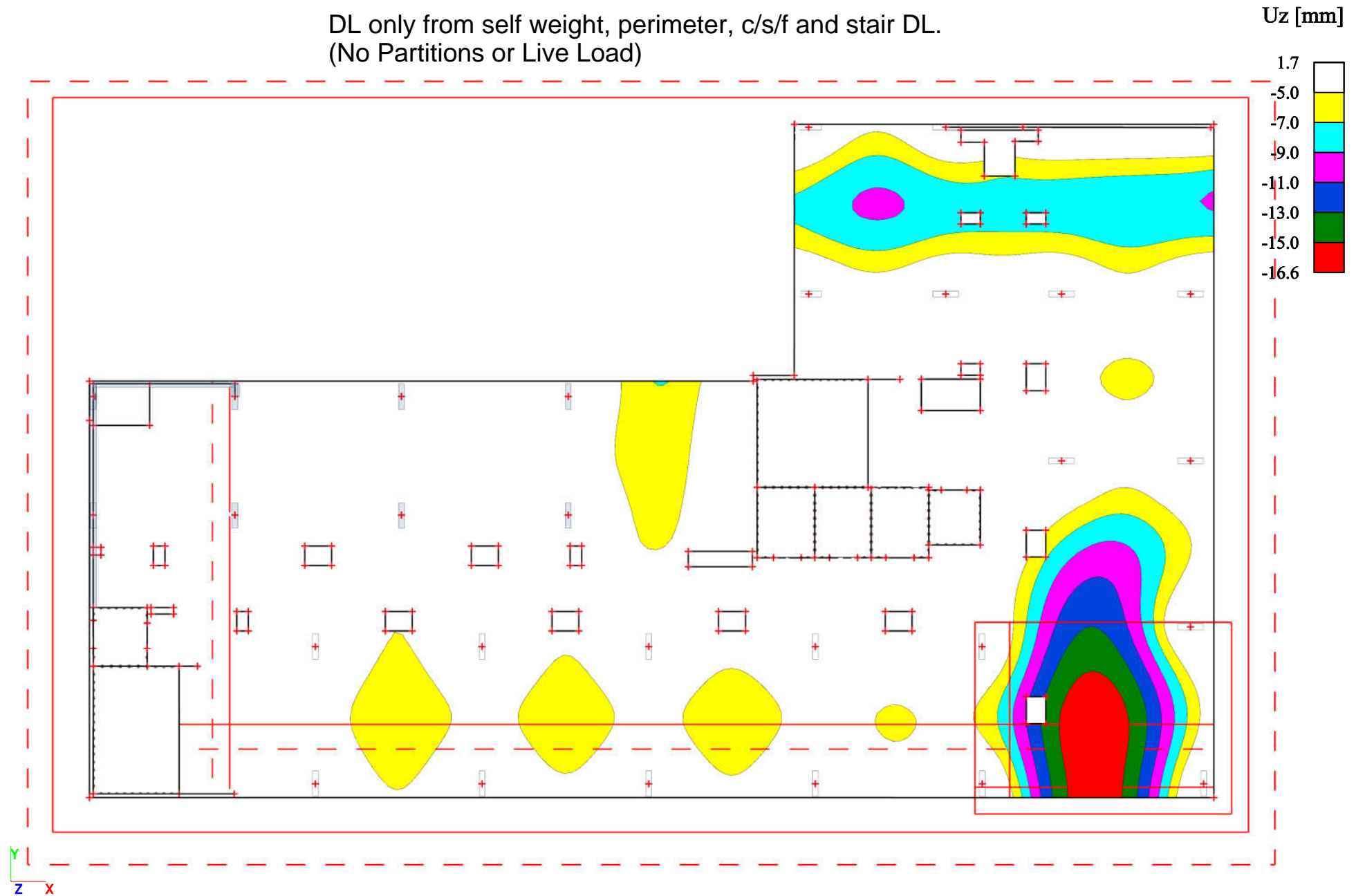
L3 - total Non Linear + creep deflection

self weight, perimeter, parts, c/s/f, stairs, 0.3 live load



L3 NL+Creep - post cladding

DL only from self weight, perimeter, c/s/f and stair DL.
(No Partitions or Live Load)



Result : Uz
Project : -

Author : -

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level 3 NL+Creep - post cladding but no c/s/f

DL only from self weight, perimeter and stair DL
(no c/s/f, no parts, no Live Load)

