Manchester Art Gallery WP23

Consultant Advice Note



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Rev.	Prepared by	Checked by	Approved by	Stage	Status	Date	Rev description
P01	JWM	RMS	RMS	4	S3	13/08/2025	First issue, for planning submission

This document uses revision codes in accordance with ISO EN 19650:

P##: Preliminary (non-contractual) - review, comment or approval.
C##: Contractual - Approved for stage completion.

This document uses status codes in accordance with ISO EN 19650:

Work in progress
S0: WIP

Shared (non-contractual)
S1: Coordination
S2: Information
S3: Review
S4 & S5: Approval

Published (contractual)
A1, **An**, etc. (where "n" relates to the project stage)

This document uses project stages in accordance with the IStructE Structural Plan of Work 2020:

2: Concept
3: Coordination
4: Technical Design
4.5 Production Design
5: Construction
6: Handover

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1. Introduction

1.1. Development Proposals

BKPL have been appointed, from a civil and structural engineering viewpoint, to oversee the refurbishment works of the Listed building, Manchester Art Gallery. There are various tasks to complete across the whole project and the development proposals related to this calculation package refer to Work Package 23. Work Package 23 is focused on the refurbishment of one of the ground floor Galleries.

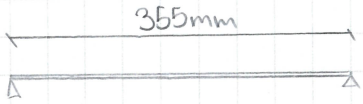
1.2. Scope

For WP23, BKPL have been appointed to comment on the capacity of the existing floorboards to ascertain if they can continue to be used following the installation of a new overboarding system, considering the additional weight from this. This stems from a comment from the Timber Survey undertaken by Hutton + Rostron which states that the floorboards are "'*now at the practical limit of serviceability in the current usage*'".

Whilst the additional load from the new build-up is structurally insignificant (0.12kN/m^2), a calculation has been undertaken to demonstrate the floorboard capacity. This report presents the relevant structural calculations.

2. Design Check

The Gallery performance specification has a general load allowance of 5.0kN/m^2 for imposed loading, along with an allowance for self-weight and dead loads. The additional load from the proposed floor build-up has been assessed, and used in calculation proof of the floorboard capacity, please refer to the following page.



- Floor Boards: 140-170mm (wide) x 18mm (Deep)
- Live Load = $5kN/m^2$
- Dead Load = $0.06kN/m^2$

Line Loads

- Live Load = $5 \times 0.17 = 0.85kN/m$
- Dead Load = $0.06 \times 0.17 = 0.01kN/m$

Safety factors:

STR: $1.35G_k + 1.5Q_k$

Factored Load = $(1.35 \times 0.01) + (1.5 \times 0.85) = 1.3kN/m$

- Bending moment = $1.3 \times 0.355^2/8 = 0.02kNm$
- Shear force = $5 \times (1.3 \times 0.355)/8 = 0.29kN$
- Second moment of Area = $170 \times 18^3/12 = 82620mm^4$

Timber Design

- Design Bending Resistance = $f_{m,y,d} = \frac{1.0 \times 1.3 \times 0.9 \times 1.1}{1.30} \times 16 = 15.84N/mm^2$

Bending stress = $\frac{0.02 \times 10^6}{\left(\frac{170 \times 18^2}{6}\right)} = 2.18N/mm^2 < 15.84N/mm^2$ ∴ OKAY

- Shear stress = $\frac{0.29 \times 10^3}{(50 \times 355)} = 0.016N/mm^2 < 1.8N/mm^2$ ∴ OKAY
- Deflection = $\frac{0.436 \times 10^3 \times 355^3}{185 \times 5400 \times 82620} = 0.24mm < \frac{span}{333}$ ∴ OKAY

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3. Conclusion

The floorboards, whilst much thinner than originally designed due to sanding, are suitable for continued use in the gallery space, along with the additional weight.

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