

# ROKBOX<sup>®</sup>

- Summary of Performance Testing Data
- Summary of Environmental Benefits (STiCH)



Sustainability Tools  
in Cultural Heritage

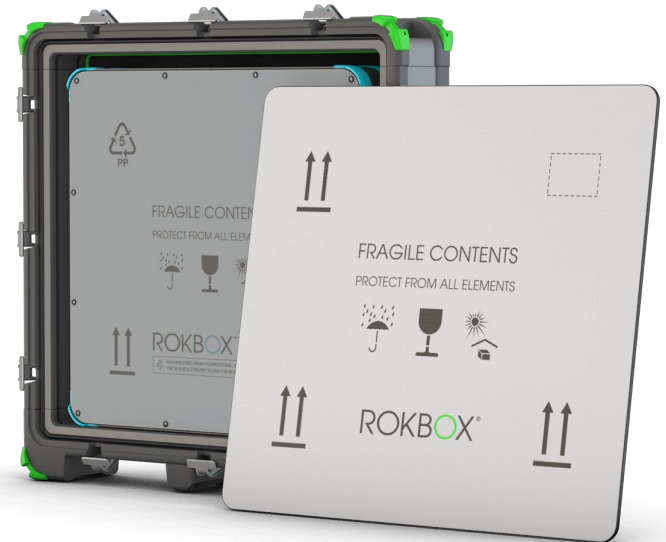


 Insurance  
Reinsurance



reddot award 2019  
best of the best

GALLERY  
CLIMATE  
COALITION



# ROKBOX Testing Methodology

---

## 1. Review Specifications

Current crating/packing used in fine art transport & storage

## 2. Review Expert Literature

- “The Evaluation of a Packaging Case for Paintings” by Timothy Green & Stephen Hackney, Tate Gallery, 1984
- “The Testing of Packing Cases for the Transport of Paintings” by S. Staniforth, National Gallery, 1984
- “Packing: A Case study” by Susan Staniforth in the National Gallery Technical Bulletin, Volume 8, 1984
- “Art in Transit Handbook for Packing and Transporting Paintings” Washington National Gallery of Art, 1997

## 3. Consult

- Conservators
- Fine art technicians/preparator
- Fine art transport companies
- Environmental/Material scientists
- Industrial designers
- Insurers

## 4. Design and Prototype

- Concept generation & Sketch work
- Initial CAD design & FEA analysis (to 4x stress margin)
- Model building & evaluation of ergonomics (via 3d printed parts)
- Full working Prototypes commissioned in actual materials
- Testing using final Test Methods (at TUV-SUD)
- Re-design to optimise Component performance
- Re-testing plus accelerated age testing

## 5. Test

- Draft comprehensive testing protocol & share with industry experts
- Develop testing methodologies with TUV SUD to execute protocols
- Employ the TUV SUD tests on prototypes throughout development process
- Use the tests to benchmark final production cases against current wooden cases

## 6. Reporting Results

- Final results, on our production cases, independently audited by Professor of Engineering from a leading British University. of Engineering to the confirm claims/conclusions
- Summary data and the main claims/conclusions contained within this document



# ROKBOX Testing Protocol

ROKBOX protocol structured to reflect critical areas of performance:

## Vibration

3.5Hz - 200Hz

## Drop

Vertical 30cm

## Topple

Full

## Forklift Impact speed

3mph & 5mph

## Water Penetration

Spray 10m & Submersion 6 hours

## Climatic Variation Temperature

22° (ambient) and increased to 42° for 18 hours

22° (ambient) and decreased to 2° for 18 hours

## Climatic Variation Humidity

Started at 50% (ambient) and increased to 80° for 18 hours

Started at 50% (ambient) and decreased to 20° for 18 hours

## Mechanical

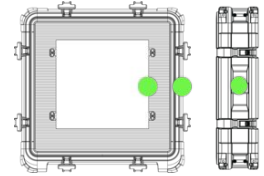
Endevco tri-axial accelerometer

Sample rate 8,200 per second

Positions on ROKBOX and wooden case

Sensor 1 at midpoint on side of case

Sensor 2 at midpoint on canvas stretcher

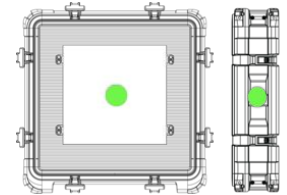


## Climatic

Temperature and Humidity Sensors

suspended in centre of case 5cm from canvas face

ROKBOX and wooden cases tested with identical polythene wraps



## TÜV SÜD

150 years of product, process, safety and quality expertise.

Evaluates the performance of packaging, and the level of protection it provides to products in transit or storage

## Accreditation

UKAS laboratory (United Kingdom National Accreditation Body

ISTA (International Safe Transit Association)



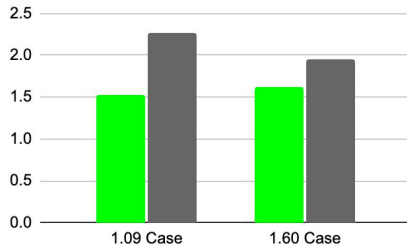
# ROKBOX Mechanical Testing Summary

|                       | VIBRATION      |         | DROP        | TOPPLE          | VIBRATION           |         | DROP        | TOPPLE          |
|-----------------------|----------------|---------|-------------|-----------------|---------------------|---------|-------------|-----------------|
|                       | ROKBOX         |         |             |                 | WOODEN MUSEUM CASES |         |             |                 |
|                       | Peak Resonance |         | 30cm Corner | Front/Rear aveg | Peak Resonance      |         | 30cm Corner | Front/Rear aveg |
| Case Size/Spec:       | 3.5-200 Hz     | G-Force | G-Force     | G-Force         | 3.5-200 Hz          | G-Force | G-Force     | G-Force         |
| 1.20 Lite Case        | 21.5           | 1.03    | 60.8        | 21.9            |                     |         |             |                 |
| 1.20 Lite Case + Foam | 26.8           | 1.37    | 29.8        | 12.4            |                     |         |             |                 |
| 1.09 Case             | 22.1           | 1.52    | 20.1        | 82.2            | 26.4                | 2.26    | 25.1        | 98.5            |
| 1.60 Case             | 22             | 1.62    | 19.7        | 75.4            | 24.3                | 1.95    | 33.5        | 98.6            |

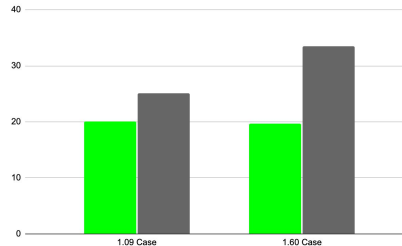
 ROKBOX

 WOODEN MUSEUM CASES

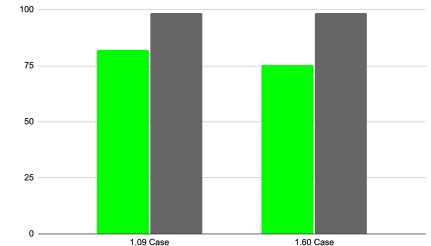
Vibration resonant peak G force



Drop Corner 30cm G force



Topple Front/Rear average G force



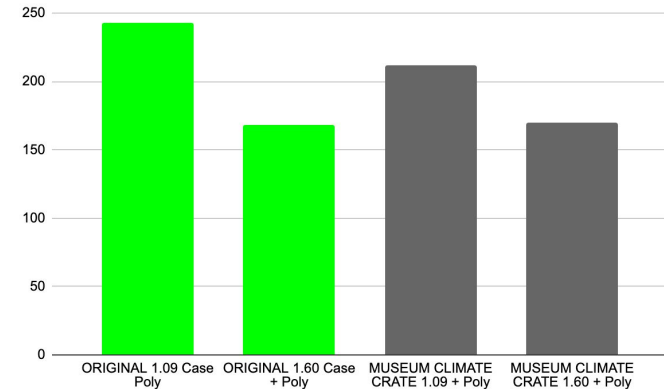
# Climatic Chamber Temperature ½ time

| ROKBOX VARIANTS |                       | Half-Time +/- 20°C |
|-----------------|-----------------------|--------------------|
|                 | Case Size/Spec:       | Average Minutes    |
| LITE            | 1.20 Case             | 32                 |
| LITE            | 1.20 Case + Poly wrap | 42                 |
| ORIGINAL        | 1.09 Case no Poly     | 151                |
| ORIGINAL        | 1.09 Case Poly        | 243                |
| ORIGINAL        | 1.60 Case + Poly      | 168                |
| NEST            | 1.6 + 1.2 Lite        | 118                |
| NEST            | 1.6 + 12 + Lite       | 151                |

| WOODEN CLIMATIC CASE VARIANTS |                 | Half-Time +/- 20°C |
|-------------------------------|-----------------|--------------------|
|                               | Case Size/Spec: | Average Minutes    |
| T-FRAME + POLY                | 1.09 Case       | 25                 |
| T-FRAME + POLY                | 1.60 Case       | 27                 |
| COMMERCIAL SPEC CASE          | 1.60 Case       | 27                 |
| COMMERCIAL SPEC CASE          | 1.60 + Poly     | 32                 |
| MUSEUM CLIMATE CASE           | 1.09 + Poly     | 212                |
| MUSEUM CLIMATE CASE           | 1.60 + Poly     | 170                |

ROKBOX vs equivalent Museum Climate Case Temperature ½ time

ROKBOX products perform the same as Wooden Climate cases

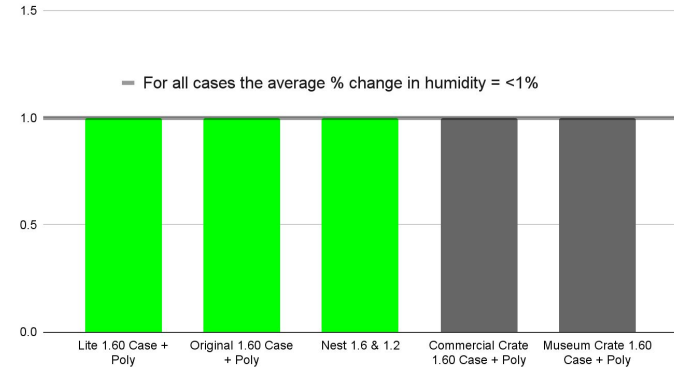


# Climatic Humidity Chamber Testing

| ROKBOX VARIANTS |                        |                  |
|-----------------|------------------------|------------------|
|                 | Case Size/Spec         | Average % Change |
| LITE            | 1.20 Case + Poly       | <1%              |
|                 | 1.60 Case + Poly       | <1%              |
| ORIGINAL        | 1.09 Case + Poly       | <1%              |
|                 | 1.60 Case + Poly       | <1%              |
| NEST            | 1.6 _ 1.2 Lite         | <1%              |
|                 | 1.6 x 12 + Lite        | <1%              |
|                 | 1.6 x 12 + Lite + Poly | <1%              |

| WOODEN CLIMATIC CASE VARIANTS |                  |                  |
|-------------------------------|------------------|------------------|
|                               | Case Size/Spec   | Average % Change |
| Commercial Gallery Case       | 1.09 Case + Poly | <1%              |
|                               | 1.60 Case + Poly | <1%              |
| MUSEUM CLIMATE CRATE          | 1.09 Case + Poly | <1%              |
|                               | 1.60 Case + Poly | <1%              |

ROKBOX and Wooden Climatic Cases perform the same in humidity protection



# Water Ingress Testing

| ROKBOX VARIANTS |           |             |                 |
|-----------------|-----------|-------------|-----------------|
|                 |           | IPX-3 Spray | IPX-8 Immersion |
| LITE            | 1.20 Case | Pass        | Pass            |
| ORIGINAL        | 1.09 Case | Pass        | Pass            |
| ORIGINAL        | 1.60 Case | Pass        | Pass            |

| WOODEN CASING VARIANTS |           |             |                 |
|------------------------|-----------|-------------|-----------------|
|                        |           | IPX-3 Spray | IPX-8 Immersion |
| MUSEUM CLIMATE         | 1.09 Case | Fail        | Fail            |
| MUSEUM CLIMATE         | 1.60 Case | Fail        | Fail            |



ROKBOX perform significantly better vs wooden Climate cases in water immersion & shower tests



# Forklift Impact Testing

| ROKBOX VARIANTS |           |              |              |
|-----------------|-----------|--------------|--------------|
|                 |           | 3 mph Impact | 5 mph Impact |
| ORIGINAL        | 1.09 Case | Pass         | Pass         |
| ORIGINAL        | 1.60 Case | Pass         | Pass         |

| WOODEN CASING VARIANTS |           |              |              |
|------------------------|-----------|--------------|--------------|
|                        |           | 3 mph Impact | 5 mph Impact |
| MUSEUM CLIMATE         | 1.09 Case | Pass         | Fail         |
| MUSEUM CLIMATE         | 1.60 Case | Pass         | Fail         |



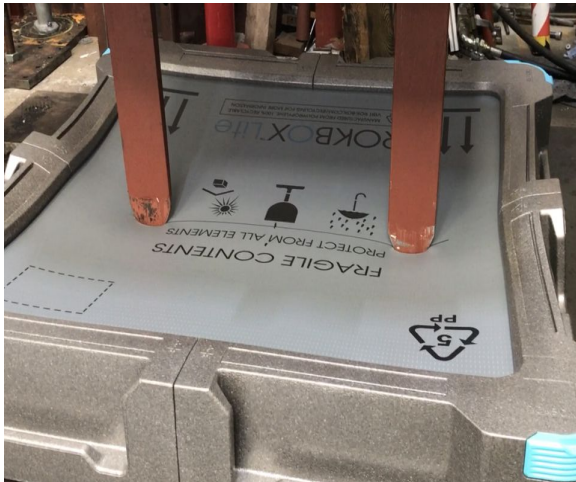
ROKBOX offer significantly better protection against forklift impact vs wooden climate crates



# Forklift Crush Testing

| 1.20 Case ROKBOX LITE |                     |
|-----------------------|---------------------|
| 6 inch Crush Test     | Max. force resisted |
| Pass                  | >1625 ft lb         |

| COMERCIAL SPEC CASE |                     |
|---------------------|---------------------|
| 6 inch Crush Test   | Max. force resisted |
| FAIL                | <925 ft lb          |

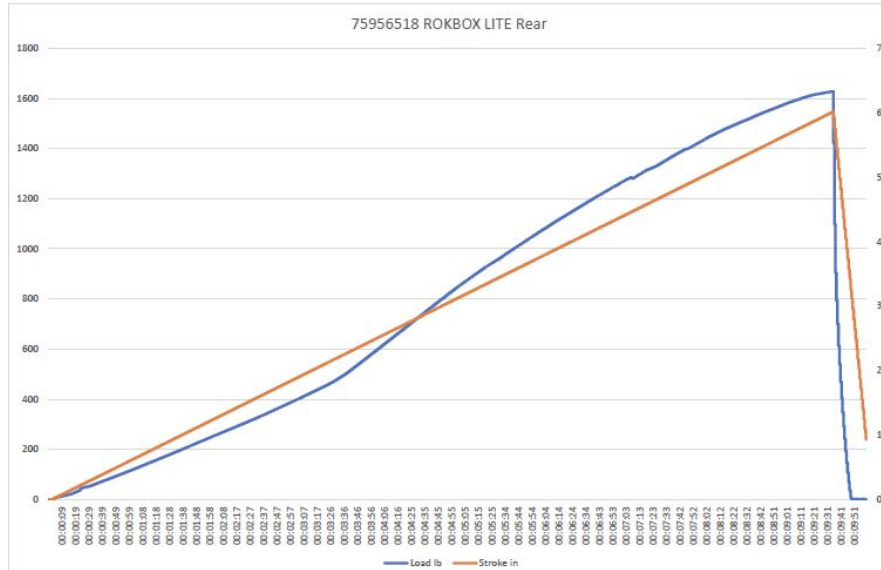


ROKBOX offer significantly better protection against forklift crush

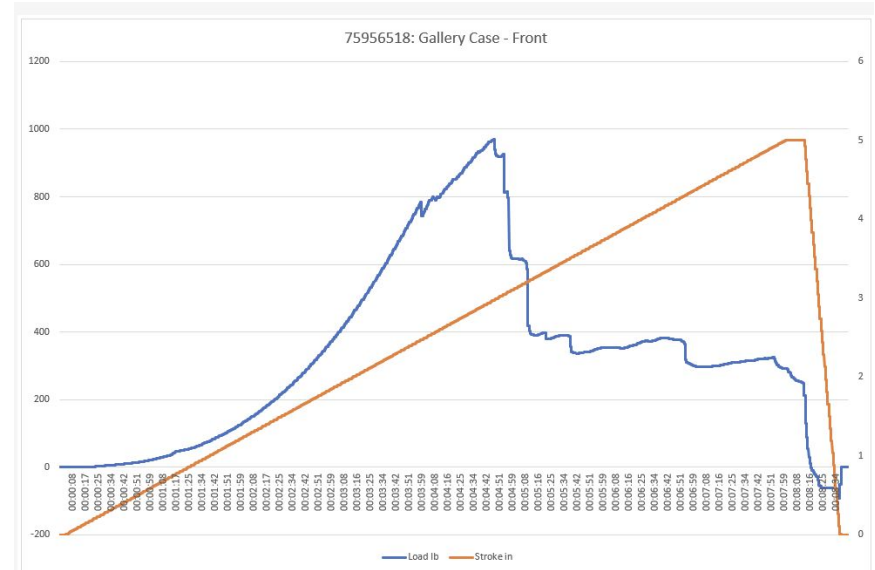


# Forklift Crush Testing

## ROKBOX LITE

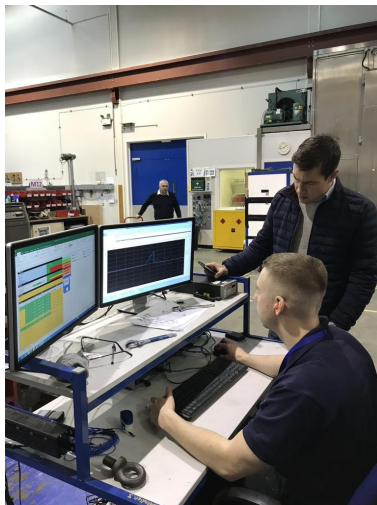
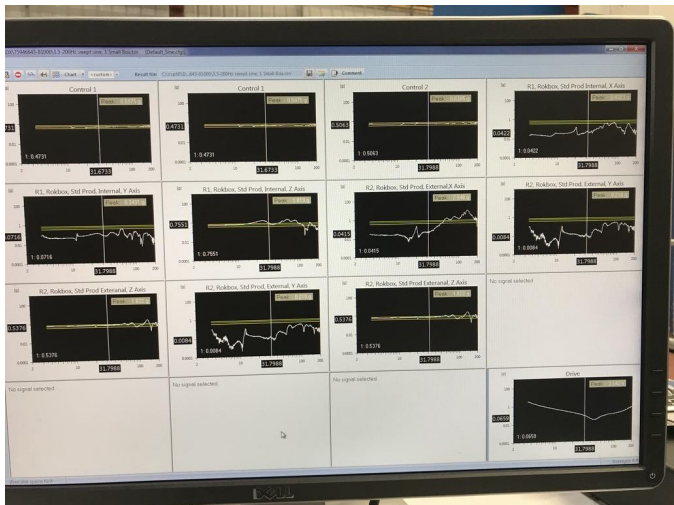
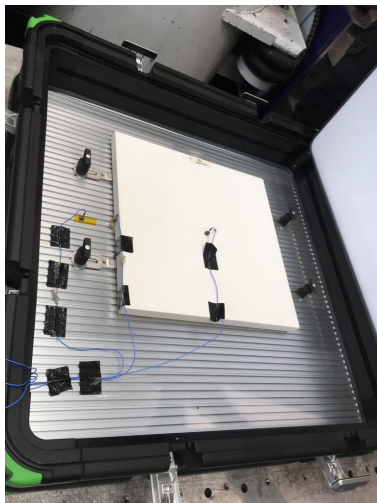


## COMMERCIAL SPEC CASE



ROKBOX offer significantly better protection against forklift crush

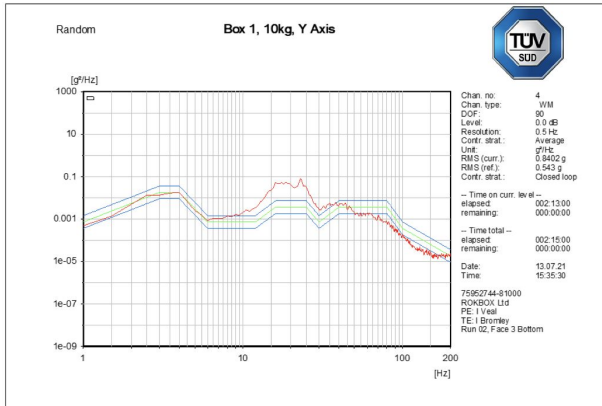
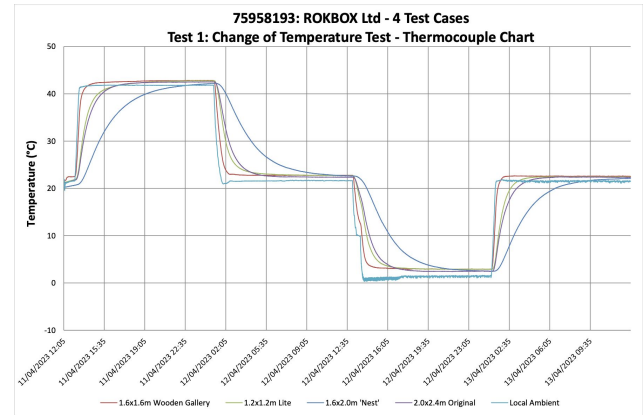
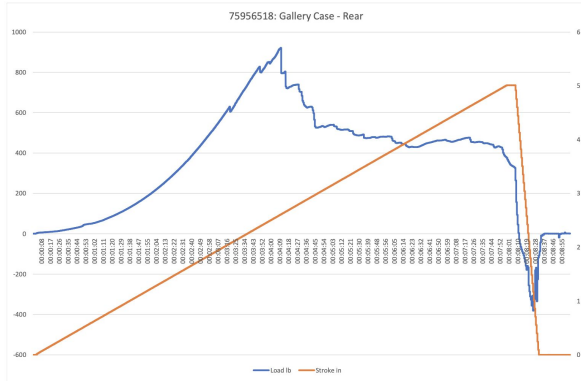
# Selection of Testing images



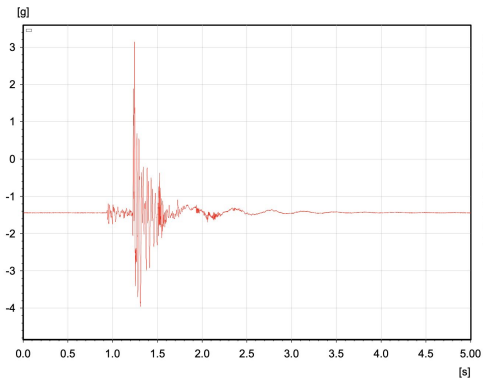
# Selection of Testing images



# Selection of Raw Data



Transient Capture R1, RB Lite in 1.6m outer, Internal, Z Axis  
Corner Drop 10, 30cm



Chan. no: 4  
Chan. type: C  
Resolution: 3.12e-04 s  
Unit: g  
Peak (curr.): -3.954 g

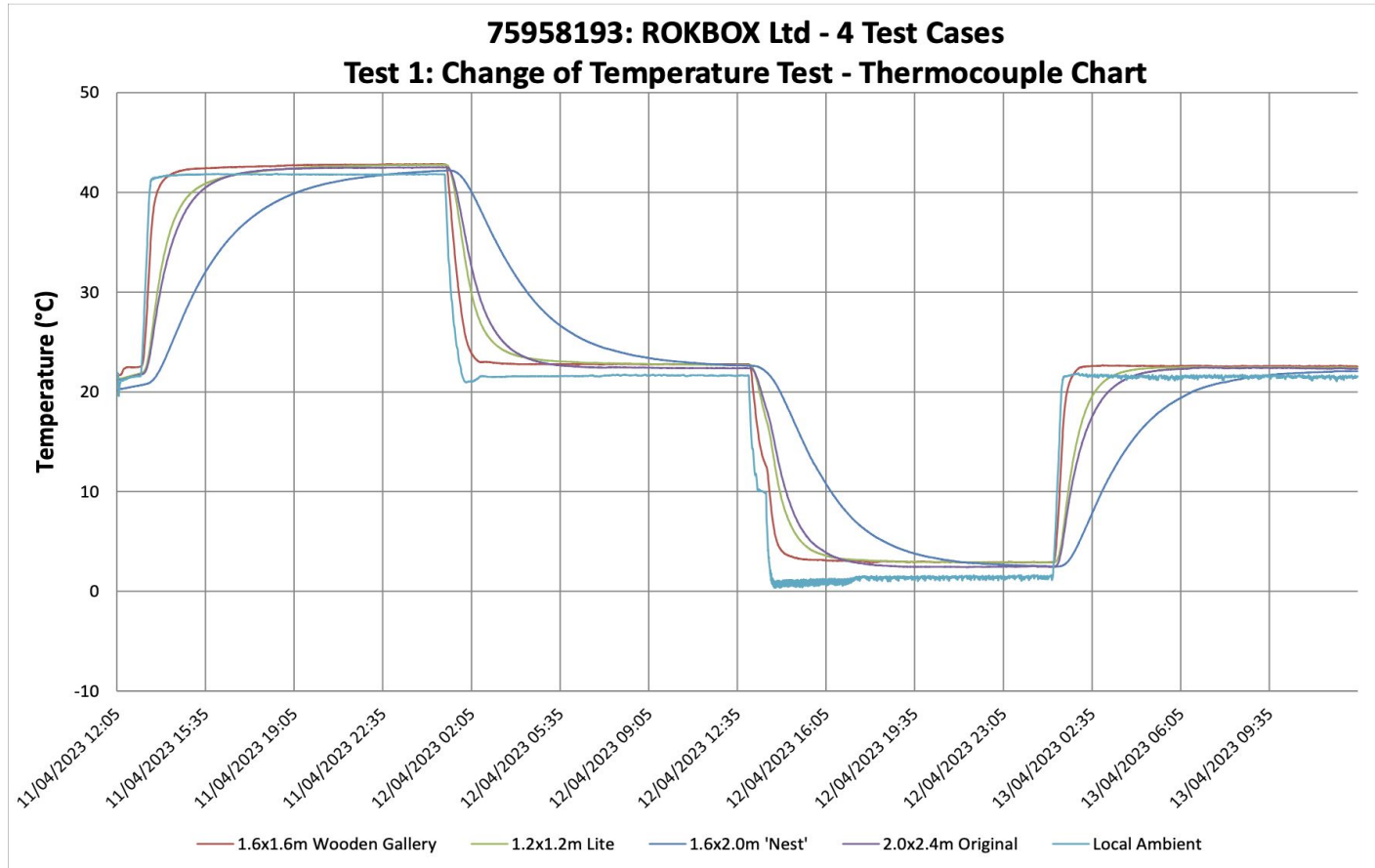
— Pulses on curr. level —  
done: 0

— Pulses total —  
done: 4

Date: 10.02.22  
Time: 12.08:51

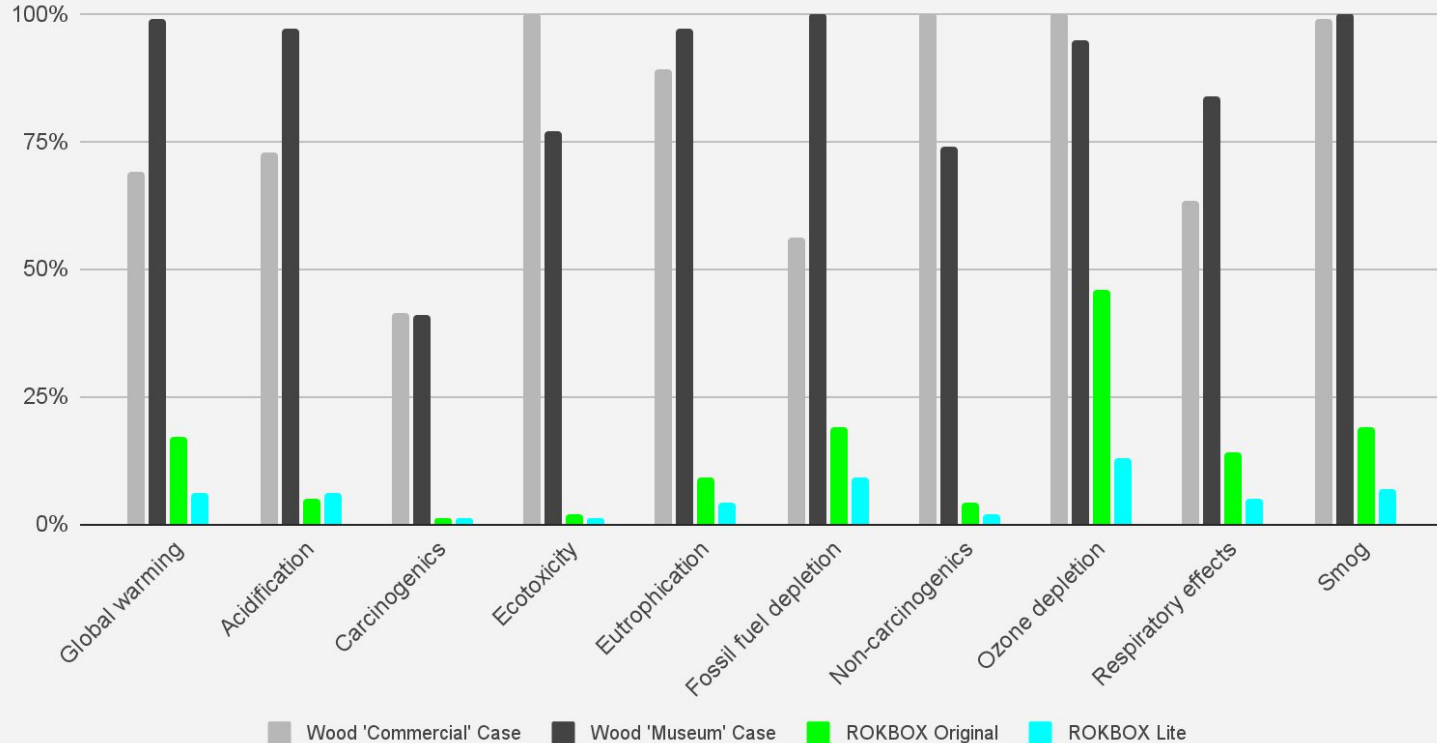
75954624-81000  
ROKBOX  
PE: I Veal  
TE: I Bromley  
Run 010, RB Lite 1.2m Wrapped Art

# Selection of Raw Data



# Sustainability Environmental Impacts

Additional environmental impacts include:



All data has been calculated in collaboration with STiCH (Sustainability Tools in Cultural Heritage)  
Pollutants expressed as a % ratio of the highest impact case measured (not all cases shown)



# Sustainability Environmental Impacts

| Relative results      | Wood 'Commercial' Case | Wood 'Museum' Case | ROKBOX Original | ROKBOX Lite |
|-----------------------|------------------------|--------------------|-----------------|-------------|
| Global warming        | 69%                    | 99%                | 17%             | 6%          |
| Acidification         | 73%                    | 97%                | 5%              | 6%          |
| Carcinogenics         | 42%                    | 41%                | 1%              | 1%          |
| Ecotoxicity           | 100%                   | 77%                | 2%              | 1%          |
| Eutrophication        | 89%                    | 97%                | 9%              | 4%          |
| Fossil fuel depletion | 56%                    | 100%               | 19%             | 9%          |
| Non-carcinogenics     | 100%                   | 74%                | 4%              | 2%          |
| Ozone depletion       | 100%                   | 95%                | 46%             | 13%         |
| Respiratory effects   | 63%                    | 84%                | 14%             | 5%          |
| Smog                  | 99%                    | 100%               | 19%             | 7%          |

All data has been calculated in collaboration with STiCH (Sustainability Tools in Cultural Heritage).  
 Pollutants expressed as a % ratio of the highest impact case measured (not all cases shown)



# ROKBOX®

Office 136, China Works  
100 Black Prince Road  
London, SE1 7SJ  
United Kingdom

[www.rok-box.com](http://www.rok-box.com)

[www.rok-boxloop.com](http://www.rok-boxloop.com)

+44(0)203 176 8573

VAT: GB 236570992

Company Reg No.: 09824787

