Testing and guidance for the external storage of lightweight material(s)

When storing lightweight materials at height, such as flat roof insulation boards and attenuation layers, consideration must be given to weather conditions—in particular the effect of wind on lightweight and unfixed materials. NFRC's guide 'Roofing and cladding in windy conditions' provides detail on how to assess the effects of high wind when working at height and includes guidance tables for sheeting and cladding, slating and tiling and flat roofing.

However, in urban areas assessing the weather forecast may not be the only thing to consider when storing materials as buildings can affect the wind speed due to their size, shape and spacing. Tall buildings provide frictional drag on the air's movement; this drag creates turbulence, which can cause rapid changes in the direction and speeds of the wind. The pattern of wind movement around buildings can be incredibly complex, with horseshoe vortex systems developing down the flanks of buildings. In addition, variations in surface temperature can cause localised pressure gradients that help form stronger localised gusts of wind.

After an NFRC Member became concerned about how to securely store unfixed lightweight roofing insulation at height in an urban environment, the company made the decision to conduct comprehensive testing, at a principal contractor's test facility, to review the various securement methods.

TESTING

The test was carried out using a wind turbine at the VINCI Technology Centre UK where the wind speed was measured using an anemometer.

During the initial baseline test *(without netting or weights)*, it was observed that a pre-packaged stack of insulation, consisting of three bundles stacked on top of each other, began to move at approximately 30 mph. Considerable lifting of the material was noted at around 40 mph, and complete overturning occurred at approximately 56 mph. The material overturned multiple times, covering a distance of approximately 15 meters.

TESTING *Continued*

In this test, a four-high stack of factory-wrapped insulation was netted without the addition of any weights.

Initial movement:
The material began to move at a speed of 40 mph.

Overturning of material:
The insulation started to overturn at approximately 42 mph.

During the test, the material overturned multiple times, causing the net to be dragged along. This raised concerns about the potential movement of the material and its potential to escape from the net.

In this test, a four-high two wide stack of individually-split insulation bundles was utilized. The15 kg weights were positioned 750 mm apart, and the net was positioned approximately one metre around the material.

Full velocity test: Despite the material collapsing during the test, it is worth noting that neither the net nor the weights lifted as a result.

The test results indicate that the configuration of the net and weights was effective in preventing their lifting even when the material collapsed. This demonstrates improved securement and reduces the potential for material escape.

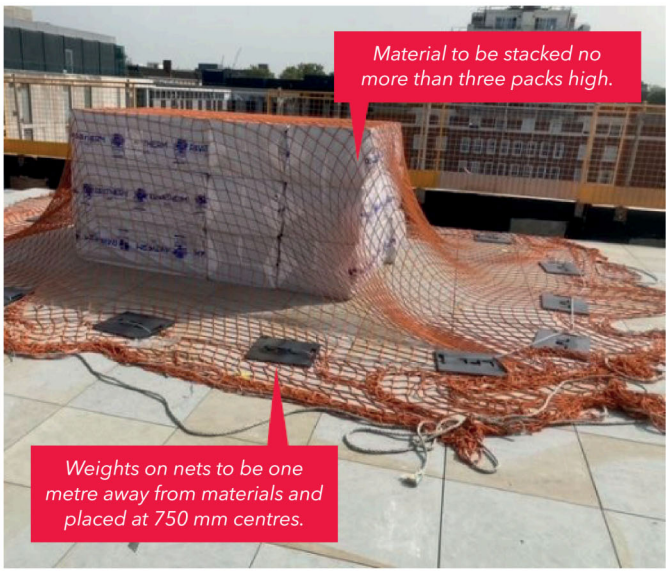
Conclusion

After conducting tests on various material, net, and weight configurations, the following conclusions can be drawn:

1. Unprotected materials, without any control measures, begin to move at wind speeds of around 30 mph. They can travel significant distances between 30 – 50 mph, depending on the size and bundle of the material.
2. Netting material alone may offer some protection, but it is insufficient as the material can still overturn and travel a considerable distance. Moreover, the movement of the material can cause the net to open, potentially allowing the material to escape.
3. The use of both netting and 15 kg weights yielded the best results, but it was crucial to ensure the correct configuration of the net and weight around the material. If the net was positioned too tightly, the material would collapse and remain within the confines of the net. However, this increased the likelihood of the net opening and the potential for material to escape due to the lifting of the weights.
4. The most favourable outcomes were observed when the material was enclosed within a netting configuration, with 15 kg weights placed approximately one metre apart, around the material at 750 mm intervals. This allowed for movement of the material within the net without any evidence of weights lifting or net opening.

The following actions should be implemented to ensure the safe storage of lightweight material externally:

- Lightweight materials, if stored externally, must only be stored under weighted nets.
- These should preferably be in complete packs. However, if one pack is opened, this too can be stored under the nets– you should only open one pack at a time.
- Material stacks must only be stored a maximum of three packs high, and lower than any balustrade or edge protection within three metres of the stored material.
- Nets are supplied as 10 m x 10 m heavy-duty cargo nets and must extend beyond the base of the stored materials by at least one metre.
- These must be weighted by minimum 15 kg weights.
- These weights must be set at 750 mm centres and should be set on the loose net one metre from the base of the material, not hanging from the net and causing tension on the net.
- Weights are attached to the net by a cable sling running the length of the net. The sling is secured with a padlock.



NFRC would like to thank the Lindner Prater Group and VINCI Technology Centre UK for undertaking this research to understand how best to store lightweight materials at height.

Published by

NFRC
020 7638 7663
info@nfrc.co.uk

www.nfrc.co.uk
@TheNFRC

May 2024

MRK262:v1.0 05/2024