Damaging Northland storm

BRANZ was on the ground in Northland last year, examining the effects of a storm on buildings. Roofs bore the brunt of the weather, with structures on exposed terrain the most vulnerable.

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House badly damaged during the storm.

IN JULY 2014, there were several extreme weather events in Northland. Windstorms along with heavy rainfall started on 8 July and continued for the next 3 days.

According to NIWA, the peak wind speed of 168 km/h (46.7 m/s) was recorded at Cape Reinga. Strong wind was also observed at other locations throughout the region, with almost 150 km/h recorded at Tutukaka Harbour and almost 120 km/h at Kaitaia. The strong winds were accompanied by heavy rain. Over 24 hours on 8 July, 159 mm was recorded in Kaitaia and 117 mm in Kerikeri.

Widespread damage to infrastructure

This event caused extensive damage and disruption over the region. Along with trees, power lines were blown down, causing power outage in thousands of properties.

The media reported significant damage to buildings and infrastructure. The heavy rainfall caused flooding in places and a major landslide near Kawakawa. Part of State Highway 1 collapsed in the landslide, causing a road closure for several days. The Insurance Council of New Zealand estimates the cost of the disaster at $18.8 million.

Shortly after the storm subsided, a 2-day visit was made to the region to observe the building performance and damage throughout the region. This focused mostly around Kaitaia, Kerikeri and Whangarei.

Buildings got off lightly

Contrary to media reports, the overall number of damaged properties was relatively small. About 20 instances of damage were observed, including non-building structures. Three buildings with significant damage ➤

were inspected, while the rest of the visited properties had minor to moderate levels of damage.

The damaged properties were mostly typical residential buildings along with some commercial premises. Common types of damage were:

- total or partial loss of roof cladding
- failure of purlin to truss connections
- roof truss connection failure.

Exposed locations bore the brunt

The houses with significant damage were located near the top of long inclines. This geographical aspect caused the wind to pick up speed as it flowed over the terrain.

All three buildings with badly damaged roofs were in exposed locations, while the other damaged houses were in relatively built-up urban environments. The correlation between building exposure and severity of damage was evident.

Most damage to metal roofs

The most common and visible damage was complete or partial loss of roof cladding. In all of the buildings with observed damage, the cladding was profiled metal long-run sheets nailed to purlins.

In most cases, the sheets were completely separated from their fixings, which remained in place in the purlins.

In other cases, parts of the roof framing were detached and lifted up by the wind. The sheets remained reasonably intact and joined to the purlins, indicating that the fixings of the purlins to trusses were the weaker link.

In one structure where the roof cladding was completely blown away, there was some additional damage to the purlins and roof trusses. Most of the purlins came off the roof, either with the cladding or separately. Some of the truss connections were damaged, although all the trusses remained in place.

Clay tiles and other damage

On parts of one roof with clay tiles, the connections to the trusses became loose, and some of the fixings were bent.

Large garage doors in a commercial facility were detached from both the side tracks. The windows next to the doors were also damaged, and some cladding elements were torn off the walls, perhaps because the loss of the door pressurised the building from the inside.

Interiors suffered once roofs failed

A consequence of damage to roofs was damage to the interiors of the properties and contents caused by the wind and rain. All the properties with significant roof damage were uninhabitable following the storm.

Once the roof cladding failed, the ceiling and roof space became vulnerable. Ceiling tiles were seen scattered all over the interior of properties, while the insulation material was scattered both inside and outside the buildings.

Danger from flying debris

Of the three buildings with significant roof damage, large parts of the roof claddings were blown significant distances away from the dwellings - often well outside the property boundaries. This indicates the potential danger to adjacent properties and their occupants.

With the metal roof claddings, other components such as purlins became dislodged and were blown some distance off the roofs. The loose pieces possibly flew as debris or projectiles, again with serious potential for causing damage to other properties and injury to people.

Reminder to secure materials on construction sites

At least one building under construction was damaged. The unsecured edges of roof claddings were damaged, and some loose building materials were scattered.

This underlines the importance of adequately securing all building materials to avoid possible damage and injury from flying debris.

Farm building and signs also damaged

At least one farm structure was badly damaged. One of the side walls had collapsed, resulting in distortion and disintegration in parts of the semi-circular roof.

Two roadside signs in and around Kaitaia were also affected, with one completely ripped off the foundation and the other one developing a lean.

Simplified calculations of strength of the posts indicated that the wind speeds reached at those locations were at least at the same level (about 120 km/h) as recorded by weather stations in the region.

Lessons from the storm

The 2014 Northland storm once again demonstrated the damage potential for buildings in strong winds.

Factors such as terrain characteristics, exposure of buildings, roof properties and construction types were identified as having influenced the performance of buildings during the storms.

These are also likely to be significant factors in built environments throughout New Zealand. Property owners, designers, builders, planners and local authorities need to be aware of these factors for accurate evaluation of the risks and probable consequences.