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This document is a translation made by SHK of the original response in Swedish to the safety recommendation. In case of discrepancies between this translation and the Swedish original text, the Swedish text shall prevail in the interpretation of the response.

Swedish Accident Investigation Authority

FAO: Jonas Bäckstrand and Tomas Ojala

Umeå, 01/11/2021

Martinsons Byggsystem AB's response regarding the recommendations in Final Report RO 2021:01 — Collapse of the roof of Tarfalahallen in Kiruna, Norrbotten County, 7 March 2020

The Swedish Accident Investigation Authority ("**SHK**") has asked Martinsons Byggsystem AB ("**Martinsons**") to respond with confirmation of what action has been taken as a result of recommendations issued to Martinsons in Final Report RO 2021:01 — Collapse of the roof of Tarfalahallen in Kiruna, Norrbotten County, 7 March 2020 ("**the Final Report**").

In the Final Report, three of SHK's recommendations are directed at Martinsons — *RO 2021:01 R3, RO 2021:01 R4* and *RO 2021:01 R5.* The following is an account of what action Martinsons has taken and intends to take in future as a consequence of these recommendations.

RO 2021:01 R3

"Martinsons Byggsystem AB is recommended to:

- *Implement the measures necessary in order to ensure that stability is considered in an appropriate manner when the load-bearing capacity of sub-tensioned wooden structures is being dimensioned. (RO 2021:01 R3)"*

Response:

At an early stage following the collapse of the roof of Tarfalahallen, Martinsons set up a working group for the purpose of obtaining a more in-depth understanding of the mechanism of action of the construction principle and the significance of the parameters and boundary conditions specified. The working group has consisted of internal experts from Martinsons construction department and external experts through outside designers.

The working group has mainly focused on the stability and behaviour of compressed load-bearing parts of the structure of the roof truss. Martinsons' organisation has been informed of important conclusions from this work in parallel with the work proceeding. The work within the working group has also given us valuable insights into what needs to be taken further and raised in other forums outside of Martinsons' organisation. While the work has been taking place, we have clearly seen how widespread the problem in question has been within the industry. Consequently, we, together with our trade organisation, Swedish Wood, have initiated a process in order to bring about necessary updates to handbooks and create clear guidelines and instructions for sub-tensioned roof trusses.

In concrete terms, the work of the working group has resulted in what can be described as a principle solution for creating a more de-braced and stable construction for this type of hall. In addition, the working group has, since being established, worked to produce new calculation methodology that, in a better way, takes into account the phenomenon linked to the stability out of the plane of the roof truss. The work to develop such a new calculation method is still ongoing. There is a plan to conduct a comprehensive internal information meeting within Martinsons during Q4 2021. At this meeting, the Final Report and important conclusions in respect of the investigation that have been conducted by the working group will be covered. In future, it is also intended that the new knowledge and insights from the working group will be spread to the entire organisation through workshops and training programmes.

In addition to measures linked to dimensioning, we have also been attempting for a long time to work to as great an extent as possible with perforated plates whose hole pattern is adapted to each junction and where all the holes in the plate are to be filled with fasteners. This reduces the risk of assembly errors. In those case where we use perforated mounting plates where not all the holes are to be filled with fasteners, we are now describing important measurements in an even clearer manner.

Furthermore, Martinsons has produced a specific document in order to make this clear and to ensure this information is passed on to the consulted designer of load-bearing plate. Regardless of whether the information is to be passed on directly to the designer of load-bearing plate, through a coordinating designer or via our client, we now have clearer procedures for ensuring that necessary information is received by the designer of load-bearing plate.

RO 2021:01 R4

"Martinsons Byggsystem AB is recommended to:

- *Examine the dimensioning calculations for the stabilising secondary structures in glulam frames already delivered to customers. (RO 2021:01 R4)"*

Response:

Since the working group was set up and SHK published its report to the supervisory authority, Martinsons has examined the dimensioning methodology used on a number of frames that have been delivered. In conjunction with this, certain circumstances have been established that led to suspicions concerning deficiencies, which resulted in it being essential to implement more in-depth investigations in respect of the objects concerned.

Given that the problem which has been discovered as a consequence of the collapse of the roof of Tarfalahallen has been unknown within the entire industry for a long time and the fact that Martinsons (together with others in the industry) has delivered a large number of frames over the years, Martinsons has, as a first step, attempted to establish which of the frames delivered may be considered affected by the problem. By doing so, we can create a clear structure and plan for future examination work, which reduces the risk of omissions. Martinsons has prioritised this work and allocated available resources within construction for this time-consuming investigation.

Martinsons is now in a state where we, based on available knowledge from SHK's investigation and the working group's work, have begun a survey of delivered frames for the purpose of identifying and categorising these objects from the perspective of risk. At present, it is still uncertain what this survey

will result in. When the work is complete, we will analyse how Martinsons can most effectively and efficiently continue the work to examine dimensioning calculations for stabilising secondary structures in glulam frames already delivered to customers.

RO 2021:01 R5
"Martinsons Byggsystem AB is recommended to:

- Inform the property owner of any deficiencies in order to enable the necessary measures. *(RO 2021:01 1 R5)"*

Response:

Since the collapse of the roof of Tarfalahallen, Martinsons has been in contact with the majority of clients and property owners. In conjunction with this, Martinsons has, among other things, provided safety recommendations that are ample with respect to the maximum snow load that the specific roof structure is judged capable of supporting. Martinsons has furthermore supplied revised operating instructions regarding snow clearing to the relevant clients and property owners.

In this context, it must be pointed out that Martinsons, even before the Final Report was published, has sent, on our own initiative, information letters containing safety recommendations to certain clients of sub-tensioned roof structures for the purpose of minimising the risk of new collapses. In these the clients were encouraged to contact the developer/property owner in order to pass on the information in the letter, which Martinsons also followed up and ensured that this had actually take place.

In several cases where it has been established that there are deficiencies in the roof structure, rectification programmes with reinforcement measures have been planned by Martinsons.

Martinsons does of course intend to also continue contacting clients and property owners should deficiencies be observed in glulam frames that have already been delivered.

Best regards,

[signature]
Lars Atterfors

Acting Managing Director

Martinsons Byggsystem AB