

Tensile performance of glued-in-rod connections for larch glulam

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Introduction

Trends of the timber construction industry

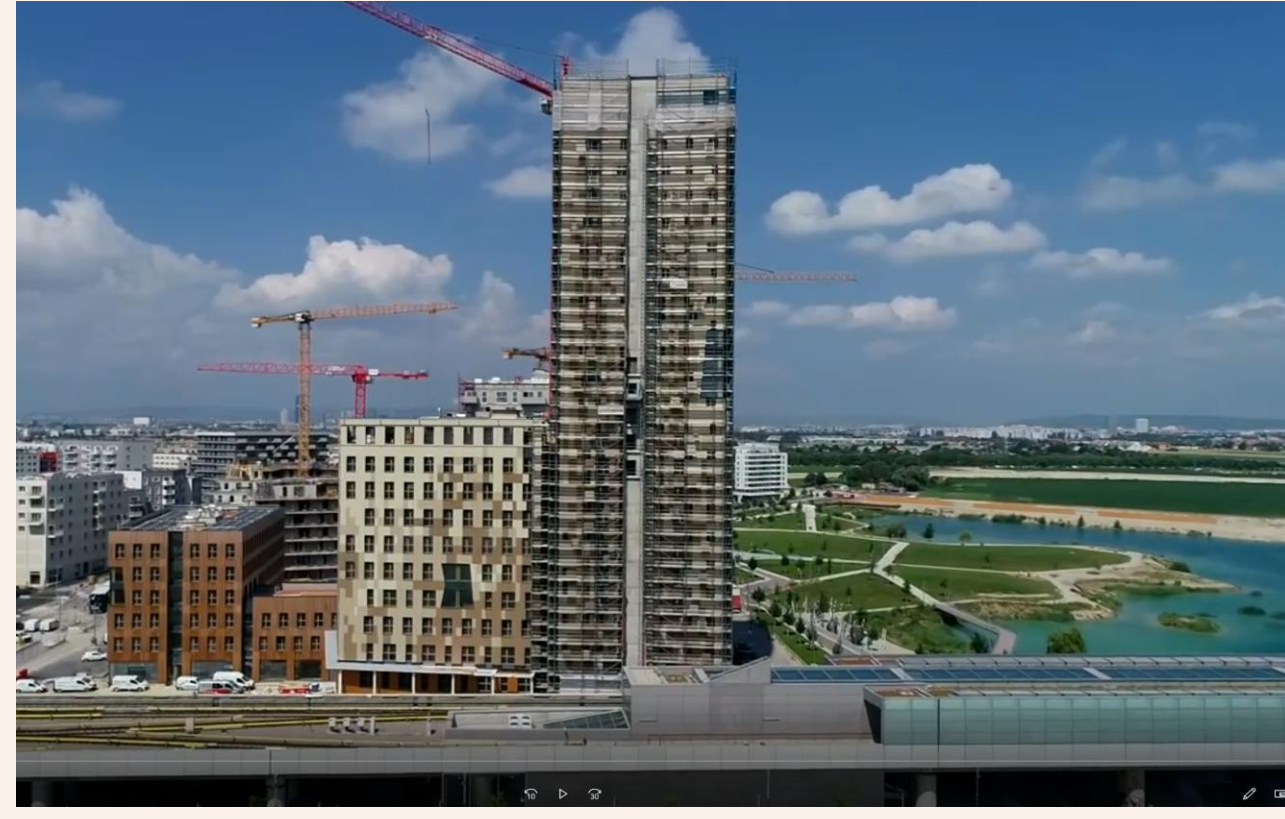
- Domestic market: Focused on low-rise housing
120,000 to 150,000 dong / year

➔ **Mid- or high-rise timber building technology is required**

- Overseas market: Focused on high-rise timber building in the city



18-story UBC wooden tower (Canada)



24-story HoHo Tower (Austria)

Prefabrication of timber members

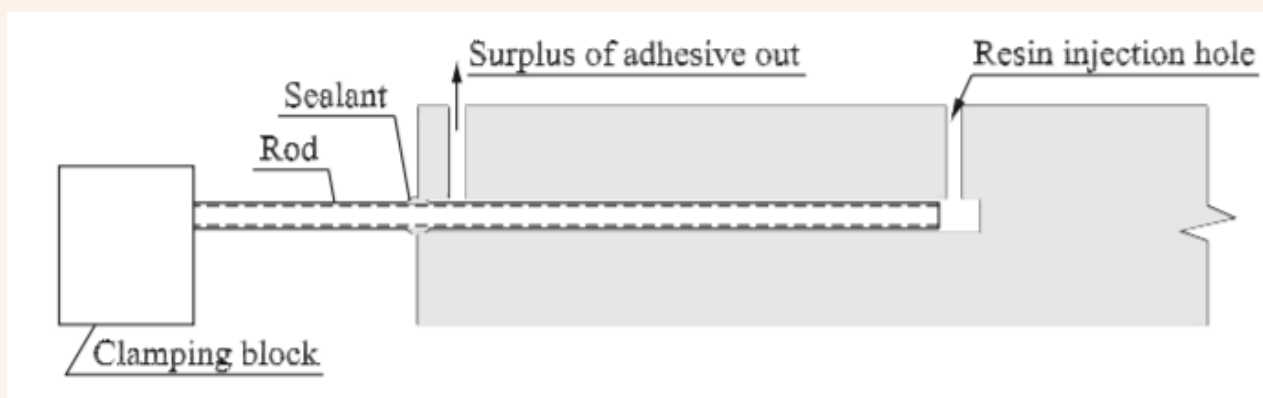
- Securing uniform construction quality
- Shortening the construction period
- Minimize civil complaints
- Reduce field manpower



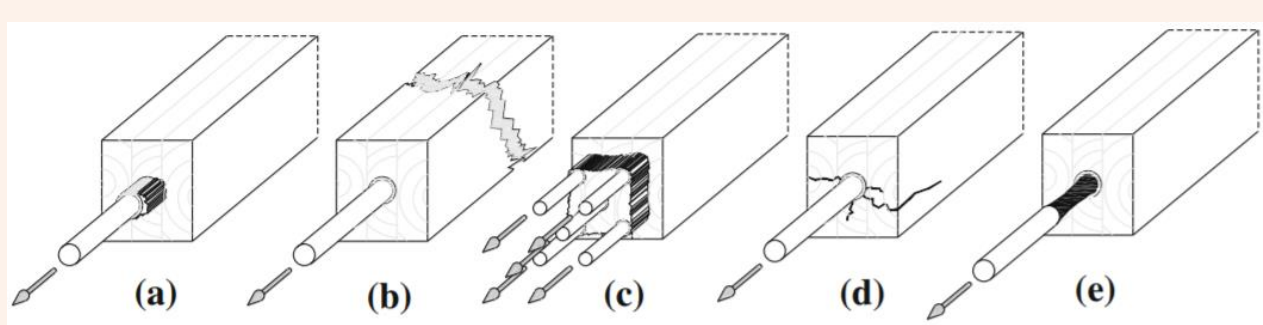
Source: Kyung Min Industrial co.,Ltd.

Glued-in-rod connections

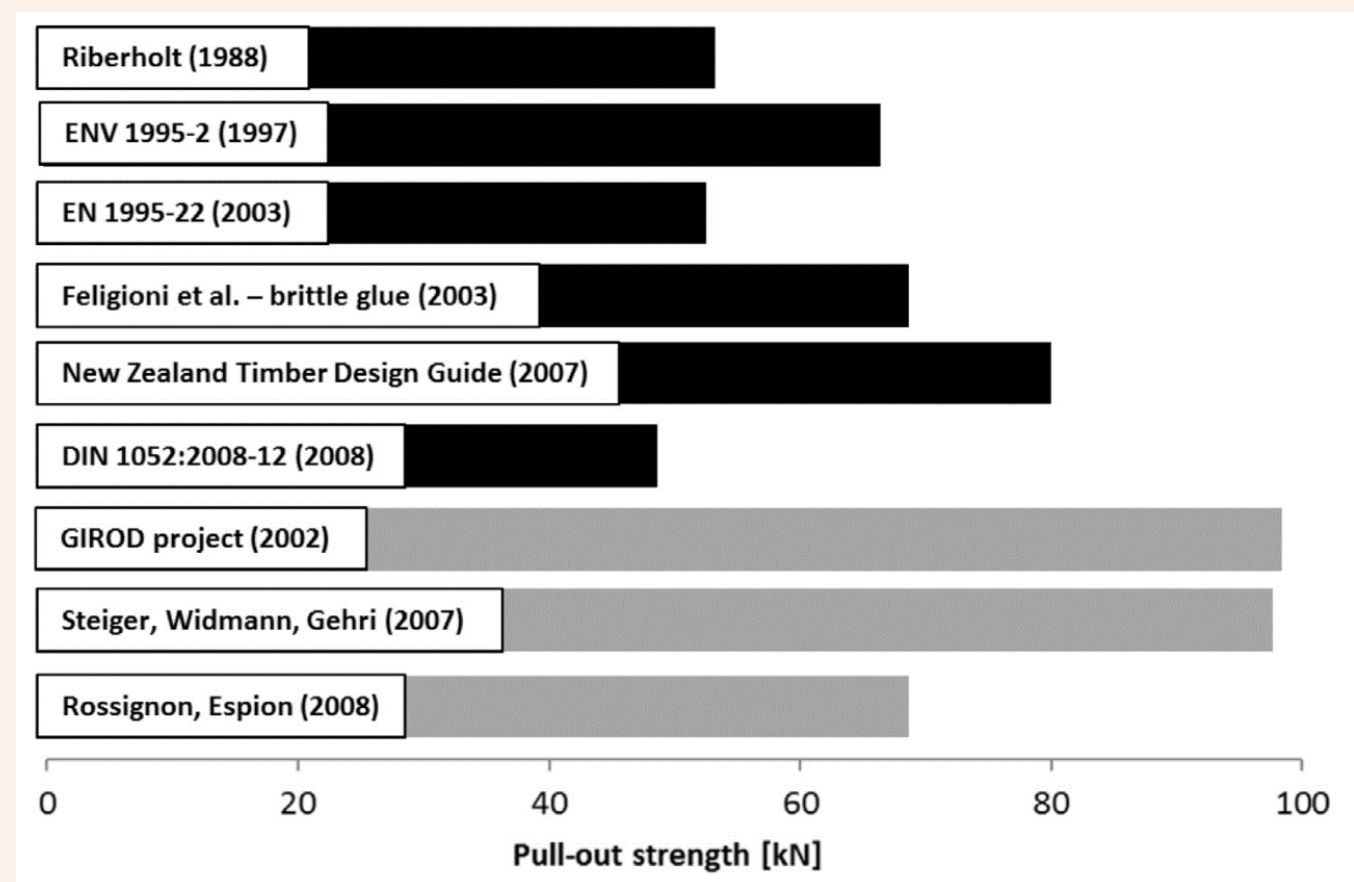
- Glued-in rods are a suitable connection method for prefabrication
- The performance of glued-in-rods has been studied abroad. and a design method has been established.



Manufacturing of glued-in-rods (Tlustochowics, 2011)



Failure modes of glued-in-rods (Tlustochowics, 2011)



Tensile capacity of glued-in-rods (Steiger, 2015)

The aim of this study

Evaluate the tensile stiffness and strength of glued-in-rod connections for larch glulam

Materials and Methods

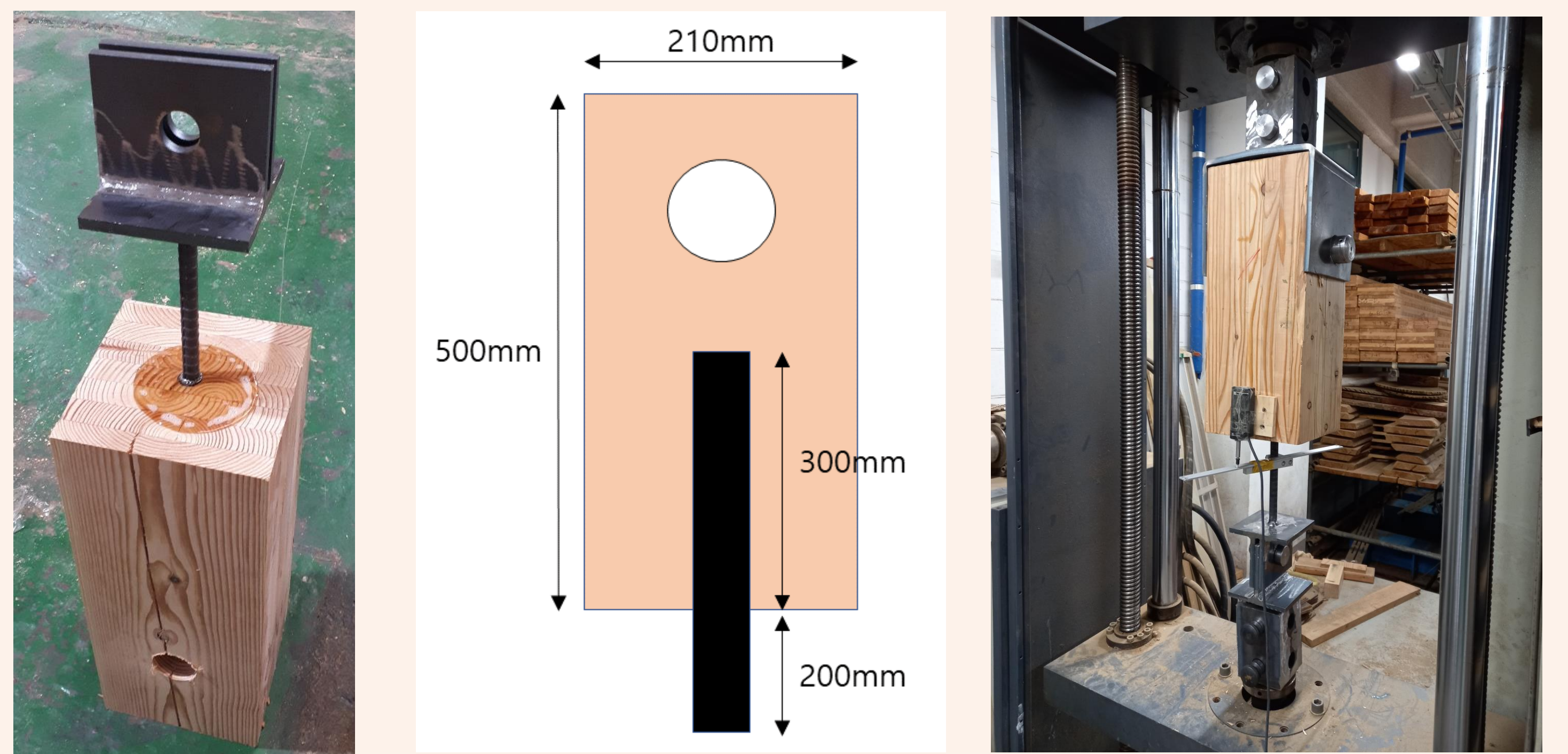
Materials

- Glulam
 - Species : *Larix kaempferi* Carr. (density: 550 kg/m³)
 - Grade : 12S-30B
 - Lamina size : 200 mm × 200 mm × 500 mm
 - Moisture contents: 10 ± 2%
- Steel (Deformed Bars)
 - Grade : SD300, Size : Ø16 × 500 mm
- Adhesive
 - Non-shrinkable epoxy resin

Experimental test

- Glued-in-rods Specimens
 - Hole size in glulam: Ø20 × 300 (depth) mm
 - Length of penetrated depth of steel bar : 300 mm
 - Number of specimens : 6

- Tensile test
 - Test method : KS F ISO 9087
 - Loading speed : 3 mm/min



<Configurations of test specimen>

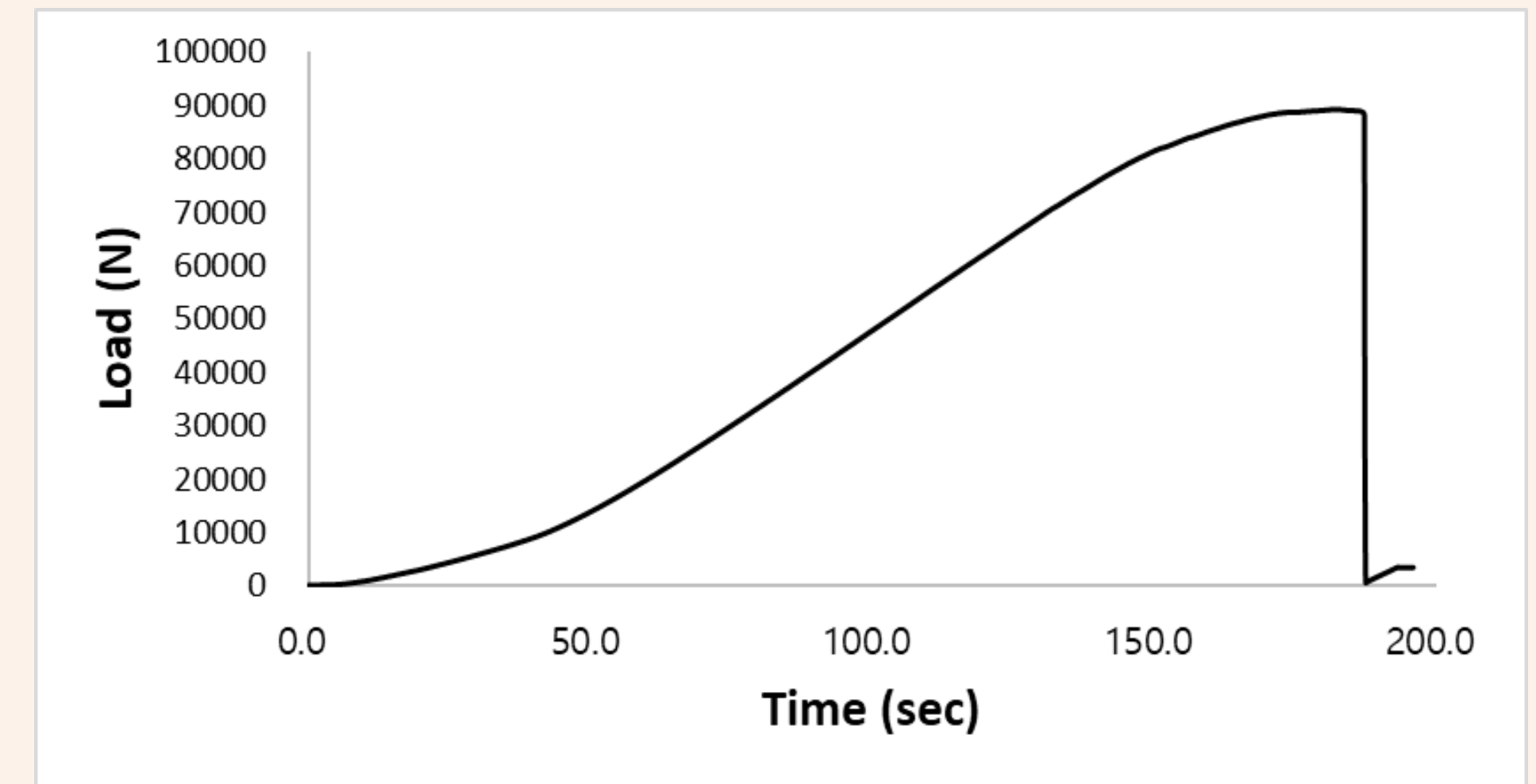
Results and discussion

Failure mode

Two of the six specimens: Steel bar was pulled out with wood
 Four of the six specimens: Un-failed at the maximum capacity of the UTM



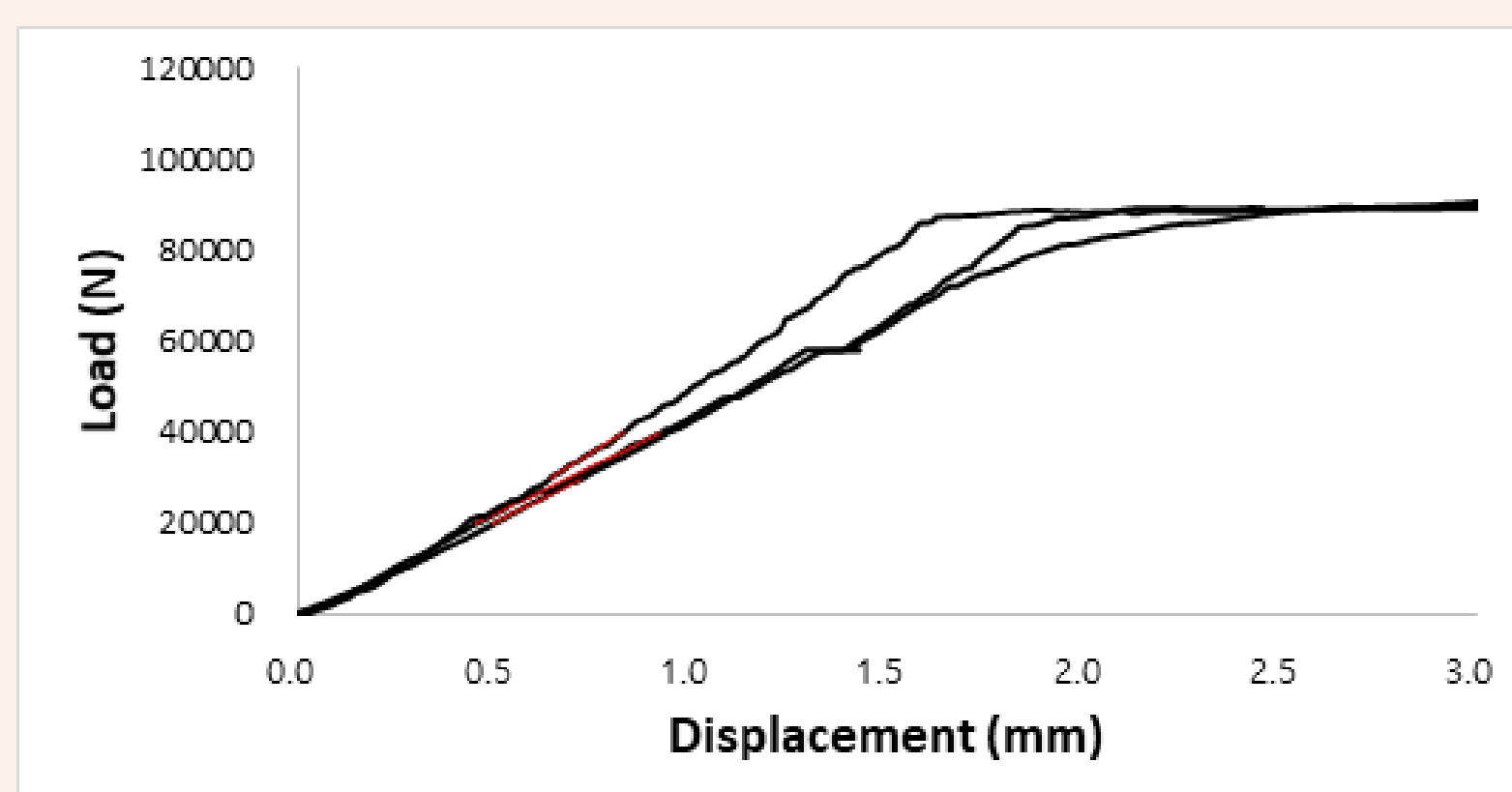
<Failure mode>



<Time-load curve>

Tensile properties

Tensile stiffness : 41.7 kN/mm ~ 54.1 kN/mm
 Tensile strength : 0.3 kN/mm (91.5kN /300mm)



<Load-displacement curve>

<Tensile test results>

No.	Maximum load (kN)	Stiffness (kN/mm)
1	100.2 (un-failed)	
2	98.5 (un-failed)	45.0
3	89.3 (failed)	41.7
4	99.1 (un-failed)	42.4
5	99.5 (un-failed)	54.1
6	99.9 (failed)	46.9
평균	97.8	45.8
5%	91.5	
COV	0.04	0.11

Conclusions

- The tensile stiffness was a range of 41.7 kN/mm ~ 54.1 kN/mm, and the average value was 45.8 kN/mm. The tensile strength was at least 0.3 kN/mm (91.5kN/300mm).
- The un-failed specimens will be subjected to periodic tensile tests in the future to observe changes in performance.