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Research and development report on the ELBROC XT 150

ELBROC
GOLD MINES

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EXECUTIVE SUMMARY

This report covers the testing of the EBROC XT 150 Prop in the laboratory. Ten props were tested under dynamic and slow conditions using the TerraTek testing machine at the CSIR Division of Mining Technology Laboratories at Carlow Road, Johannesburg.

The key results were:

- the props yielded in a stable manner
- the stable yielding capabilities of the props are + 450mm
- props can be used in fall of ground and rockburst areas
- none of the pre-stress units failed during the test

The results from these tests are indications, which design parameters may be used for support design calculations.

CONTENTS

1. DESCRIPTION of ELBROC XT 150 Prop

The Elbroc XT 150 prop is a steel prop manufactured to various lengths. The prop consists of an outer tube with ring, rod and yielding mechanism and an inner tube.

The NCM Jackpot 140 is mounted on the outer tube and is used to pre-stress the prop.

2. AIM of TESTS

The aim of the test was to compile a data base of laboratory results for the ELBROC prop to assist the relevant mining personnel designing stope support systems.

3. TEST PROCEDURE

Ten Elbroc XT 150 props were delivered and tested in the support testing laboratories at CSIR Division of Mining Technology, Carlow Road, Johannesburg on the 15th June 2005.

?? 3 props (1.5m) were tested to their full yield capacity at the slow yield rate of 30mm/min.
?? 5 props (1.5m) were tested under dynamic conditions. The first 100mm was at a rate of 30mm / min, followed by a dynamic test of 3 m/s over 200mm, the test was continued at 30mm / min until total destruction. The dynamic zone was between 100mm and 300mmof deformation.
?? 2 props were tested under dynamic conditions on a platen of 10°. Note that these results were not included in the statistical analysis.
?? All the props weighed ±35kg at a length of 1.5m

4. TEST RESULTS

Figures 1 - 9 summarise the performance of the ELBROC XT 150 Prop. The original plots and MS Excel data sheets are available for future reference.

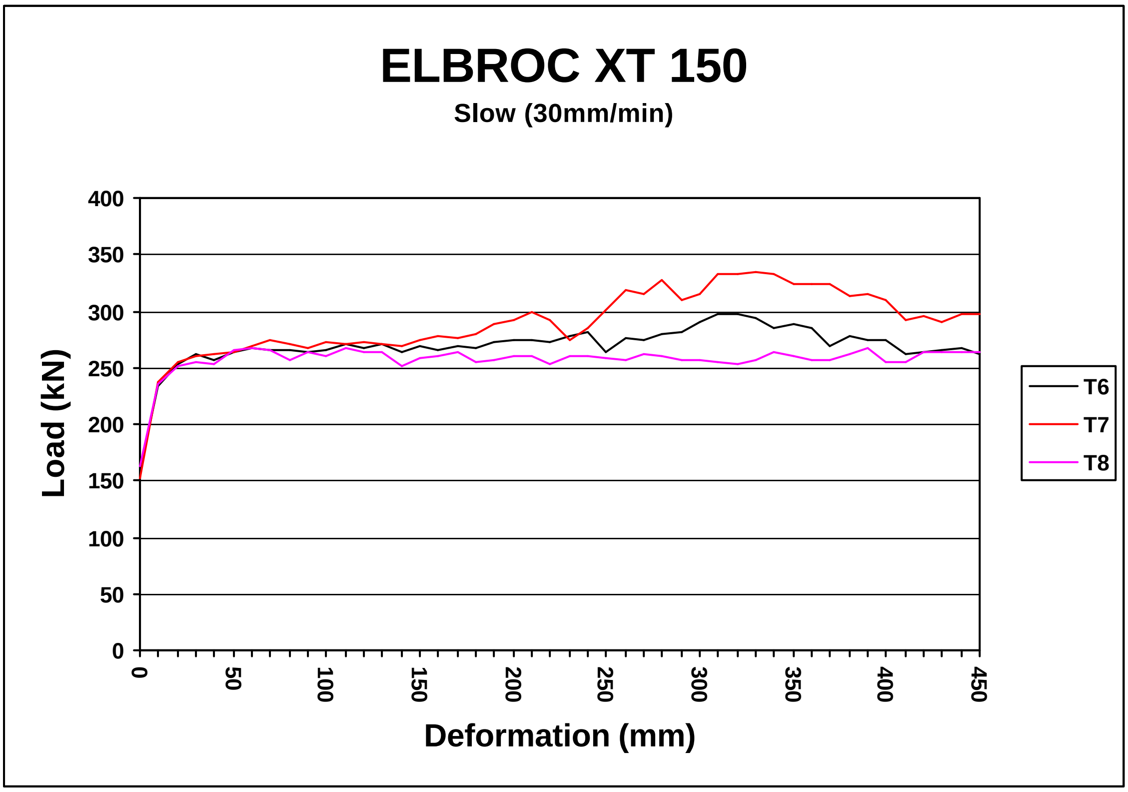

Figure 1: Load – Deformation for the slow tests.

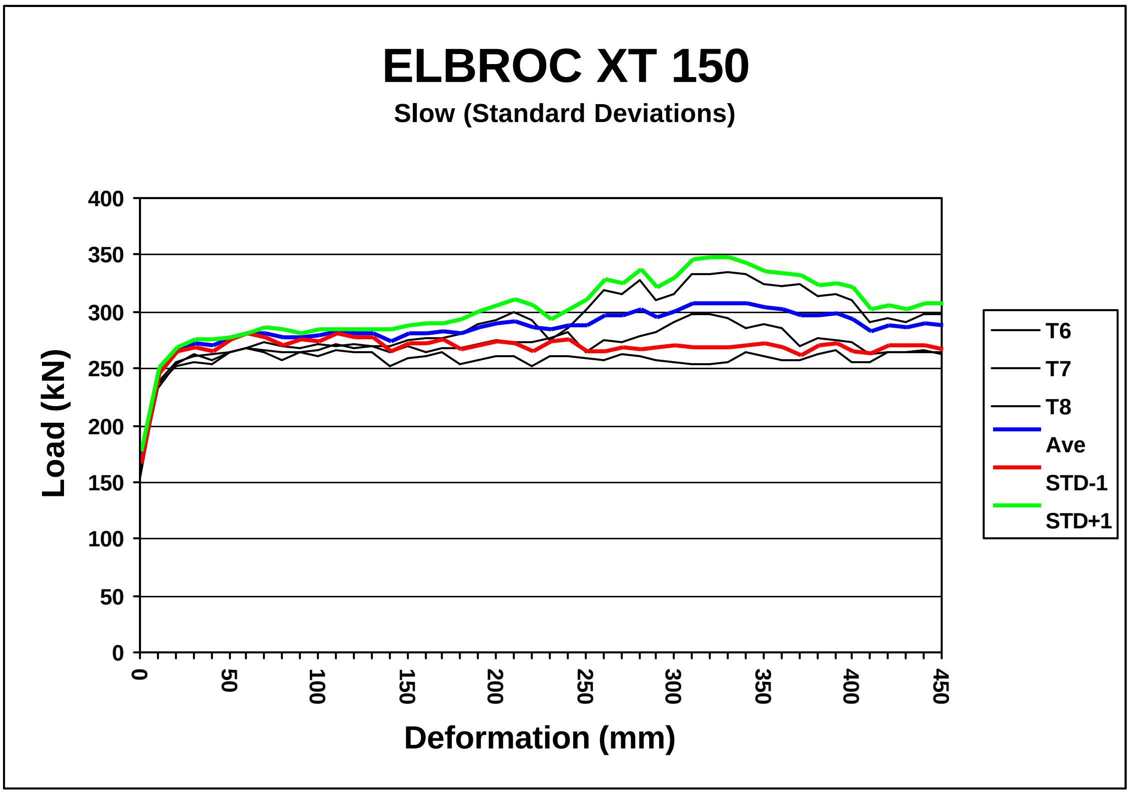

Figure 2: Standard Deviations (slow)

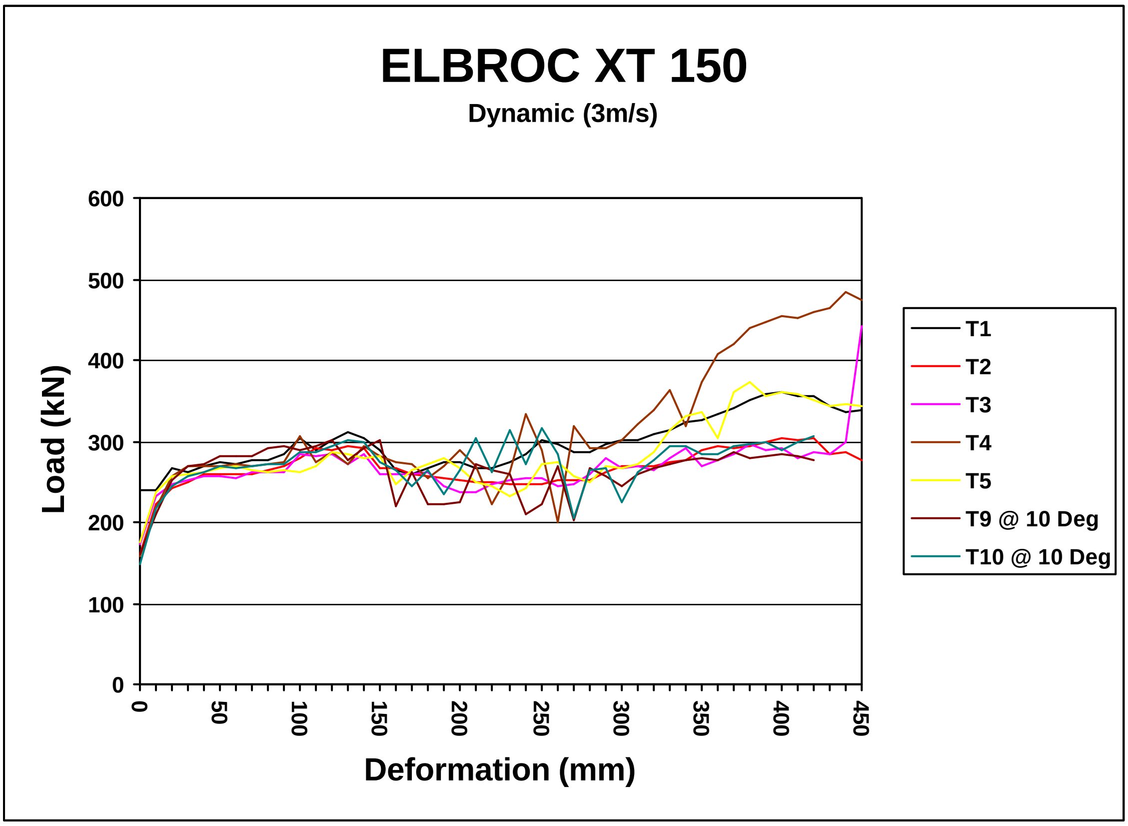

Figure 3:Load Deformation for Dynamic Test (Dynamic zone between 100mm and 300mm deformation)

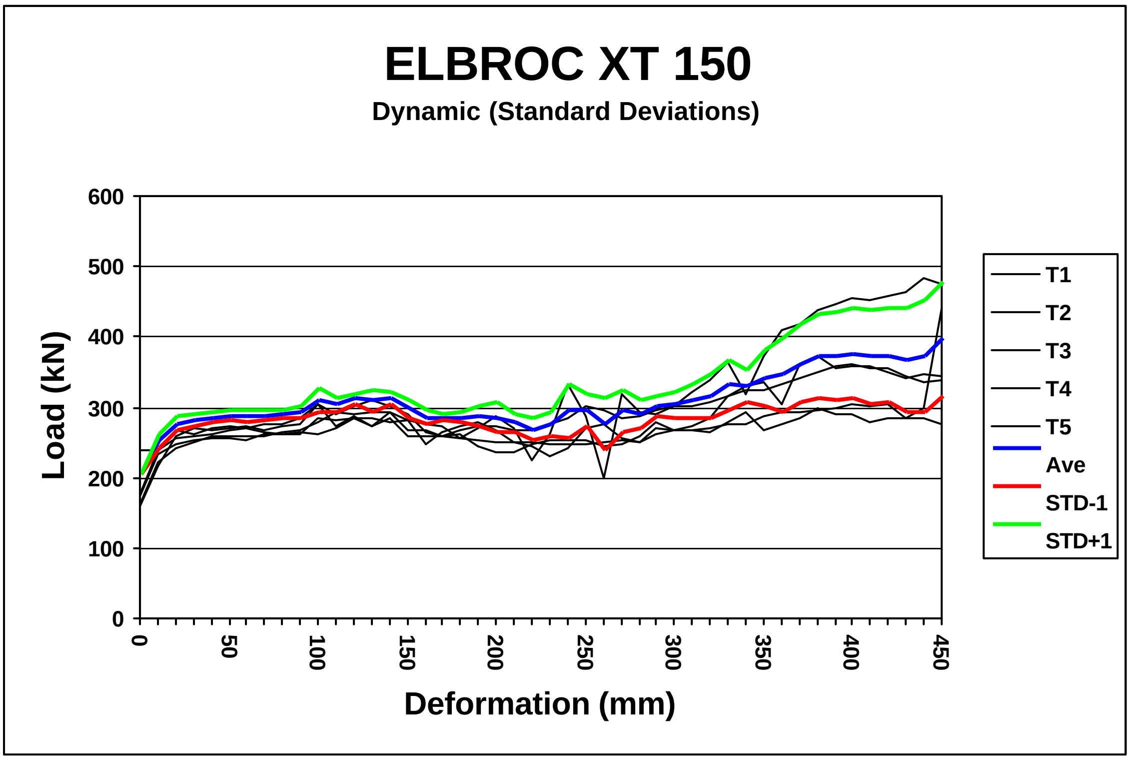

Figure 4:Standard Deviations (dynamic)

5 SUPPORT DESIGN

The data obtained from the laboratory tests, were statistically analysed and presented as graphs to assist in designing stope support systems.

To address the variability of the ELBROC XT 150 were probability curves (50%, 84%, 90%, 95% and 99%) calculated as described in “Addressing the variability of elongate support performance” by A. Daehnke in SAIMM Volume 101 No 2, March / April 2001. The support design charts were based on worst-case conditions where the hangingwall rock is discontinuous and therefore no interaction between adjacent support units.

The following basic parameters and values were used :

<u>Support Resistance</u> (S.R.) = ?gh/Area
Max Tributary Area (A) = F/ ?gh

? = density = 2.78 t/m^3
g = gravity = 9.81 m/s^2
h = height of fall of ground (as per graph)
F = support unit load (mean or peak loads)

Conversion Figures for Support Resistance

Gold	?g	27.27
Platinum	?g	30.41

<u>Absorption Underground</u> (Eu) = ?gA(v^2/2 + gb)

Max Tributary Area (A) = $\frac{E}{?h(v^2/2 + gb)}$

? = density = 2.78 t/m^3
g = gravity = 9.81 m/s^2
b = dynamic movement = 200mm
h = height of fall of ground (as per graph)
v = velocity = 3m/s
E = support unit energy absorption (as per graph)

Conversion Figures for Energy Absorption

Gold	?(v^2/2 + gb)	17.96
Platinum	?(v^2/2 + gb)	20.03

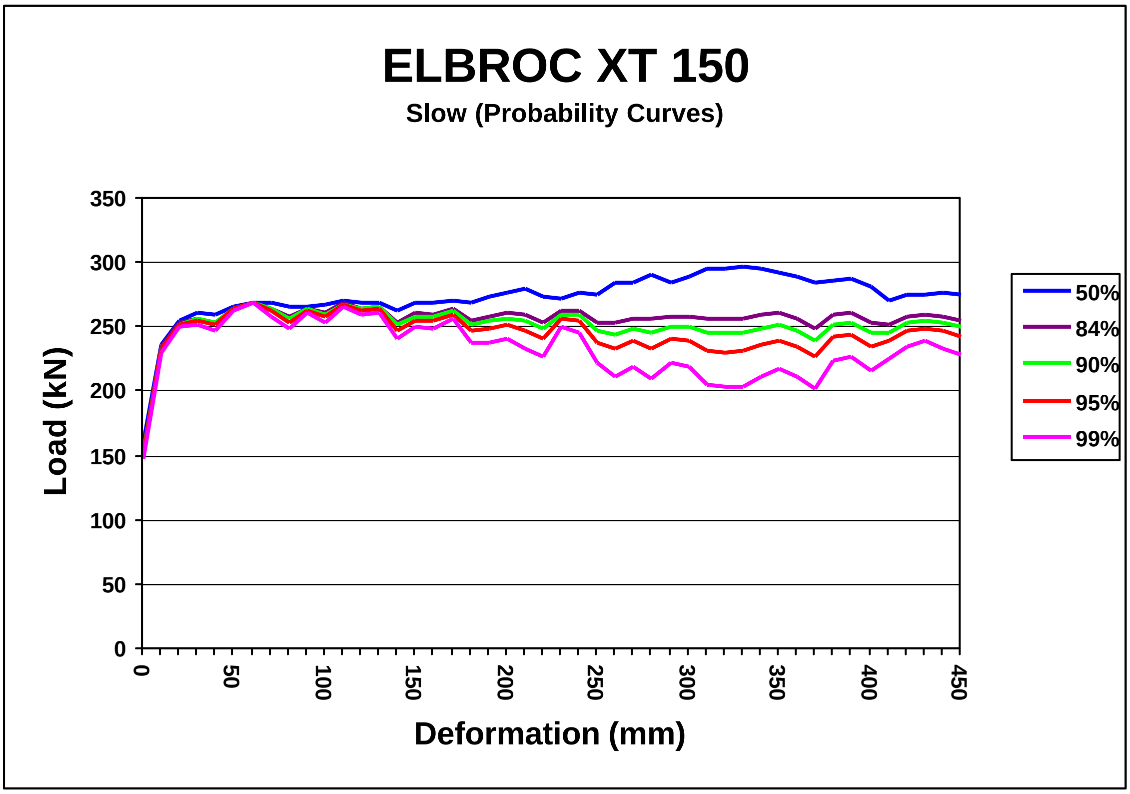

Fig 5 : Probability Curves (Slow)

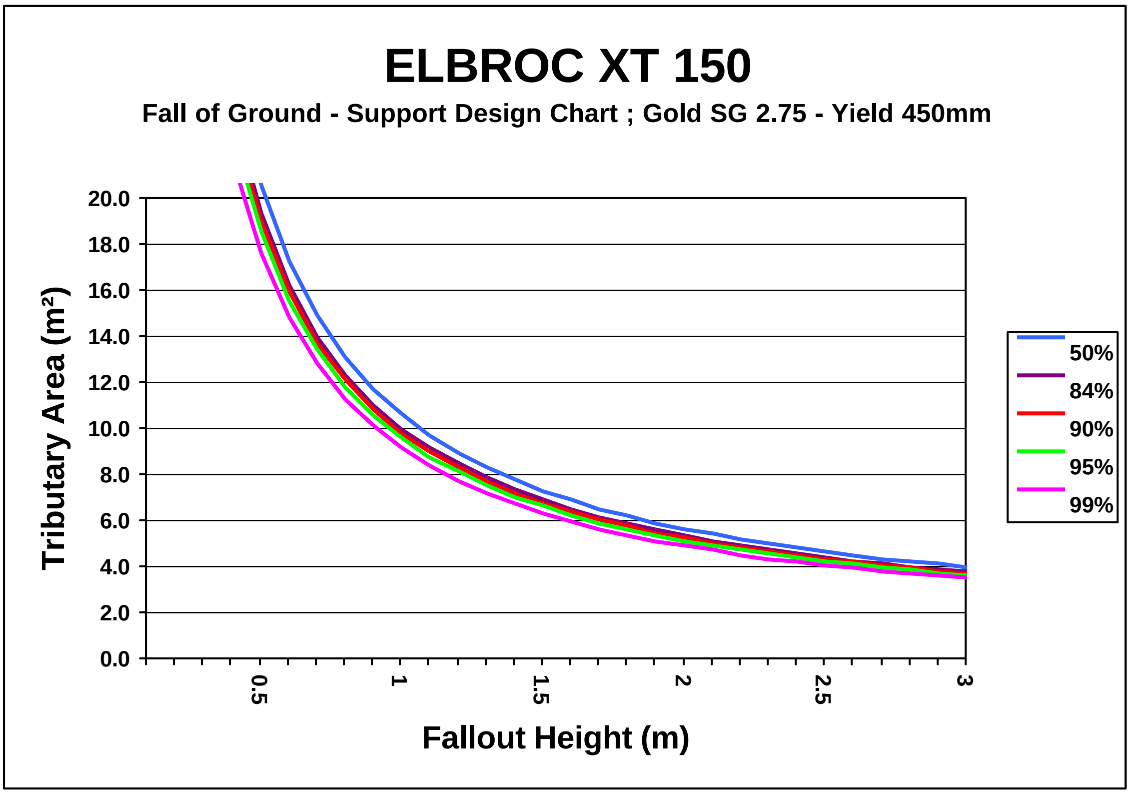

Fig 6 : Support design charts over 450mm yield (Slow)

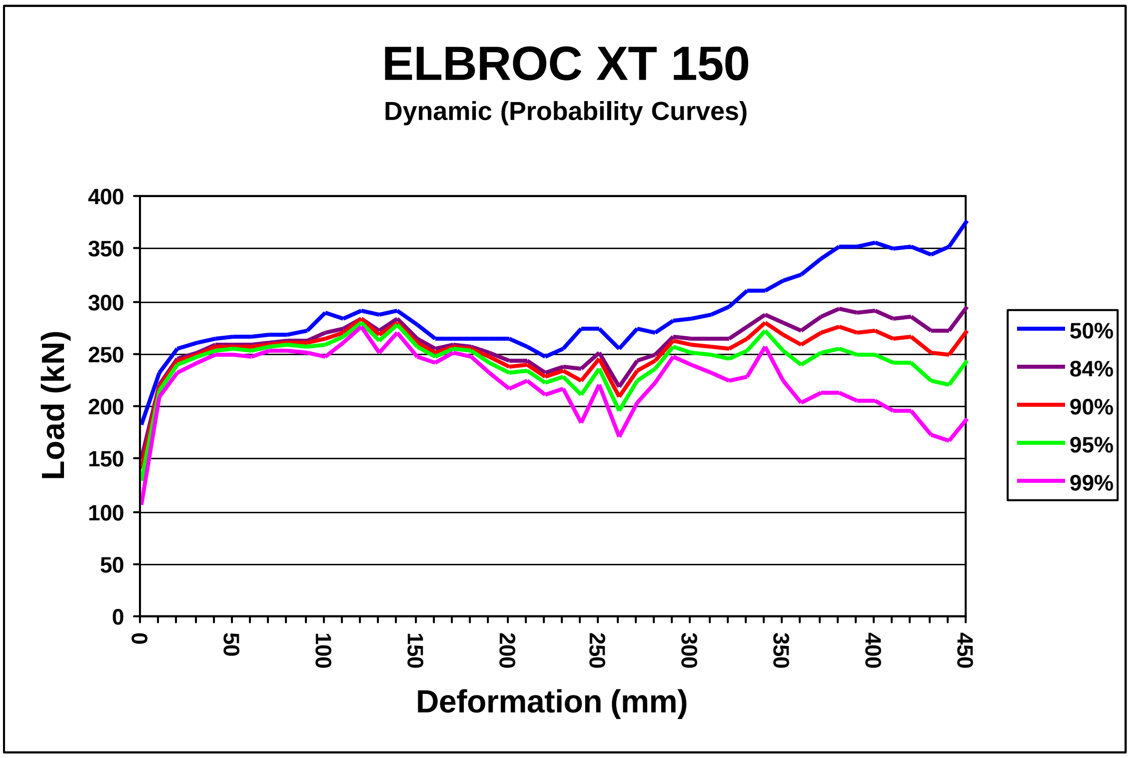

Fig 7 : Probability Curves (Dynamic)

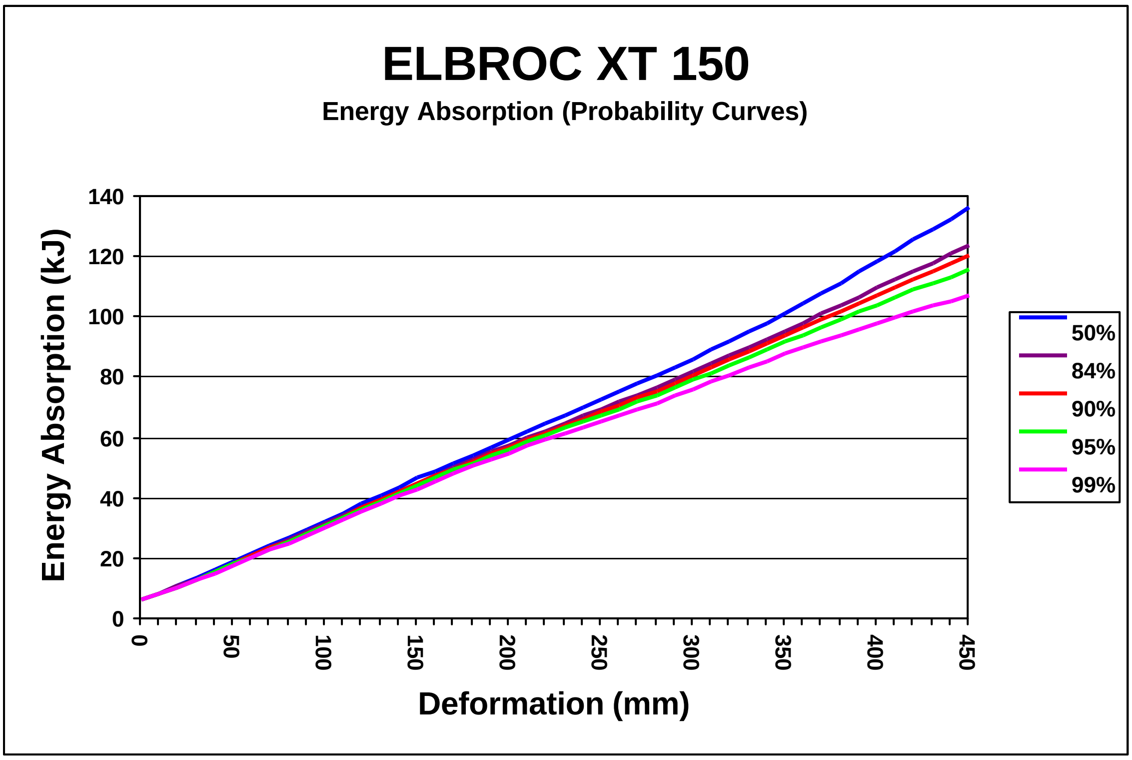

Fig 8 : Energy Absorption Curves (Dynamic)

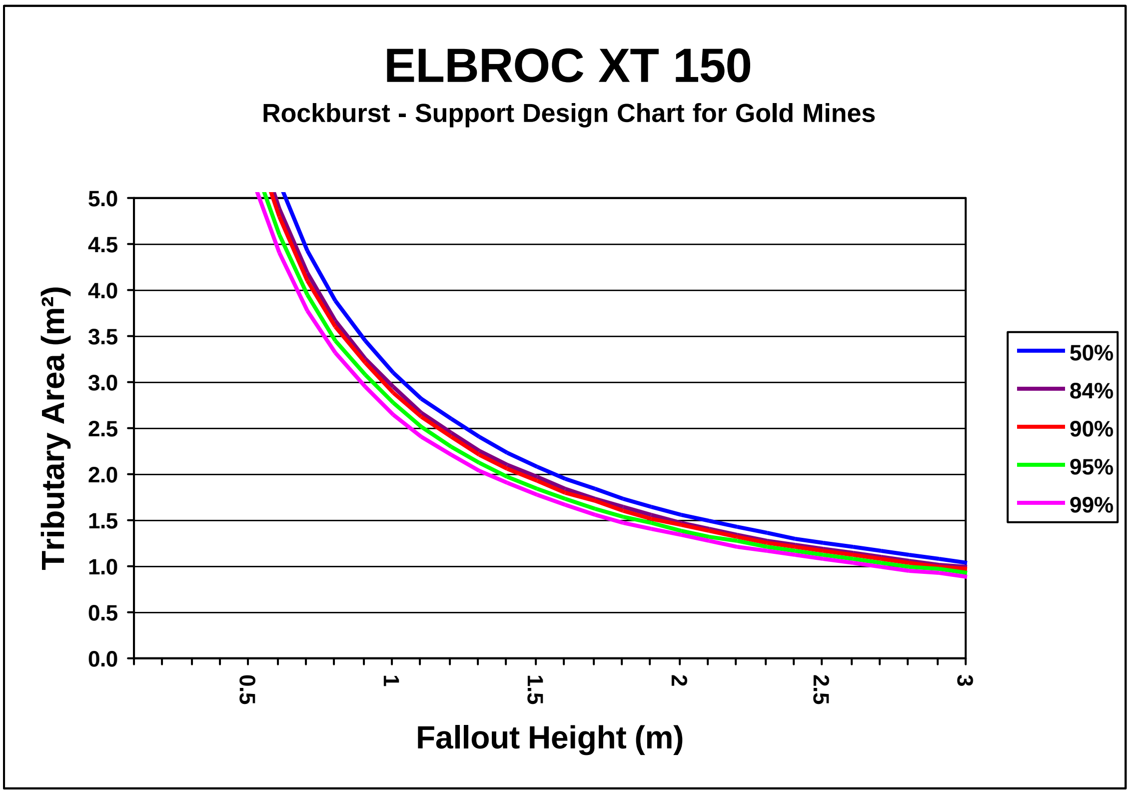

Fig 9 : Support design charts for dynamic conditions

6 DISCUSSION

The ELBROC XT 150 performed well in the tests.

- the performance under slow and dynamic conditions is consistent over the first +450mm of deformation
- all the props yielded in a stable manner
- props can be used in fall of ground and rockburst areas
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Note : The results from this test are indications which design parameters may be used for support design charts.

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