Riga Technical University
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Non-uniform moisture influence on multilayer corrugated plywood shell

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Introduction

Wood is renewable resource and is necessary for sustainability.

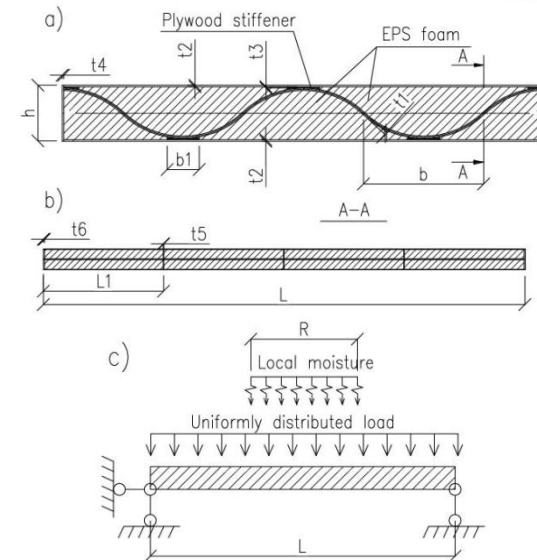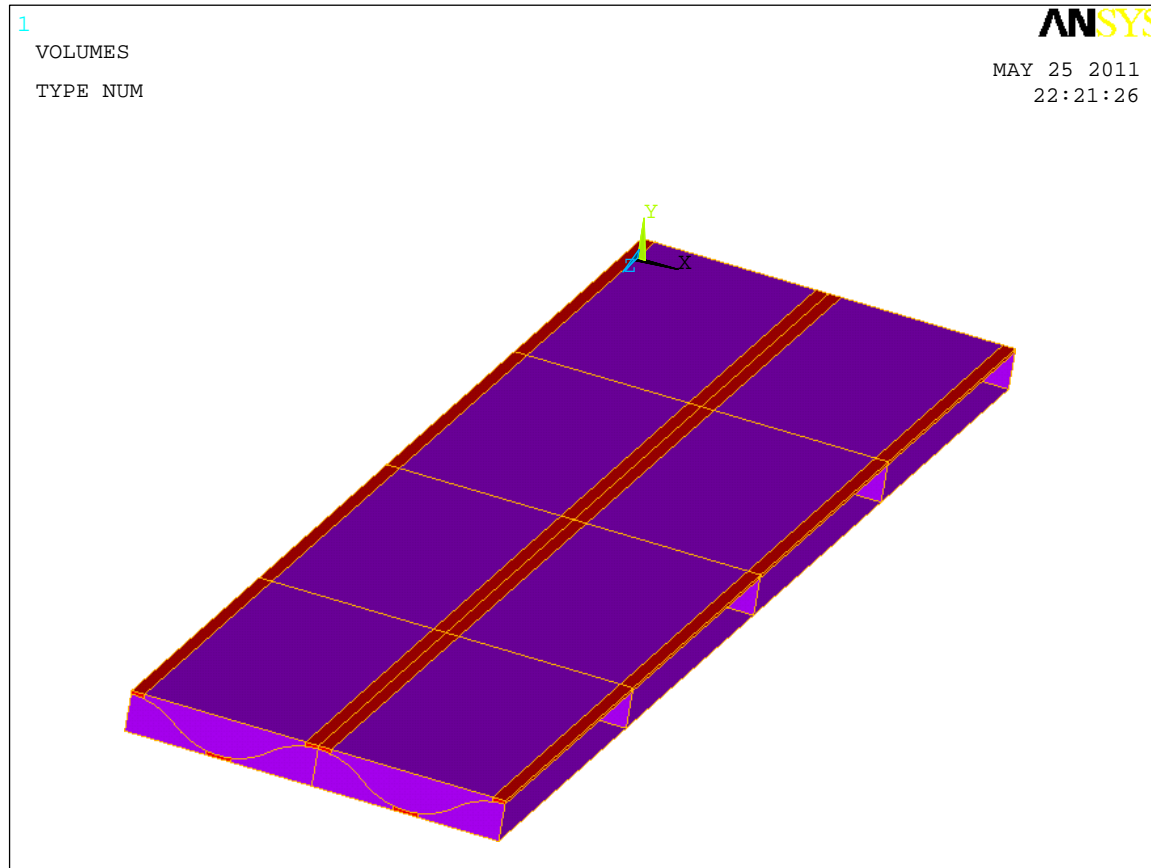One of the most effective wood products is plywood because of:
-Less sawdusts
-Large shape and size variety
-Small strength and deformation properties variation compared to natural wood and others.

Disadvantages of plywood:
-higroscopic properties
-large amount of glue necessary in manufactureing
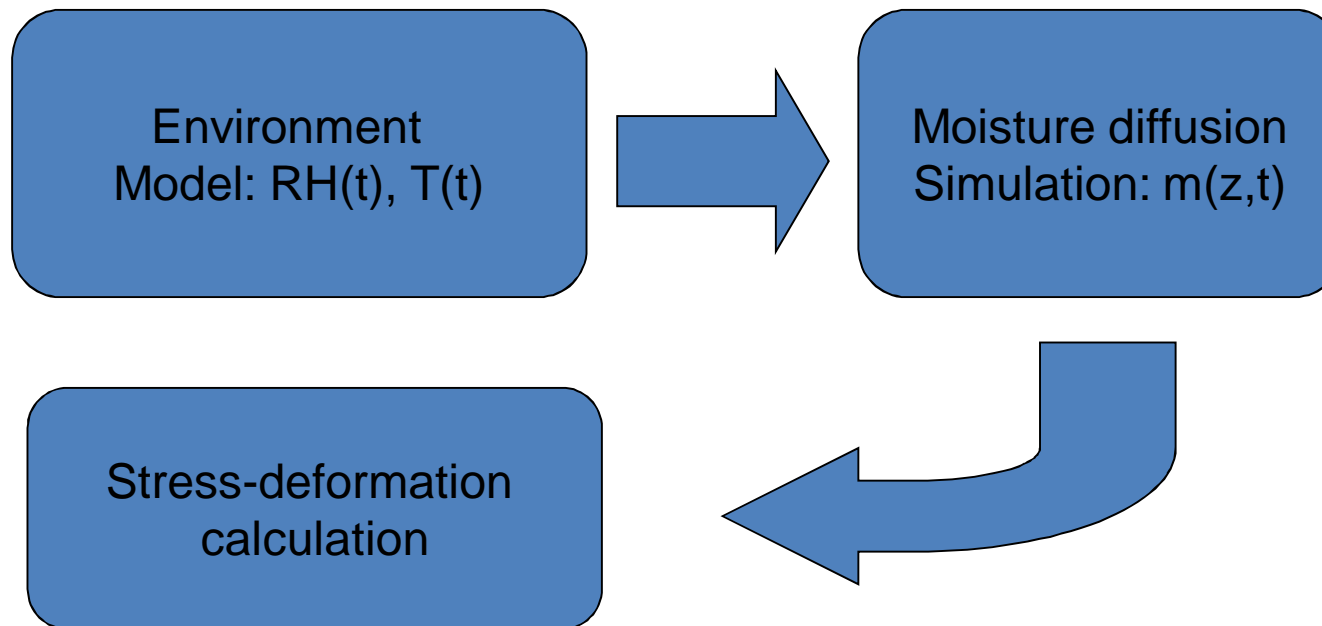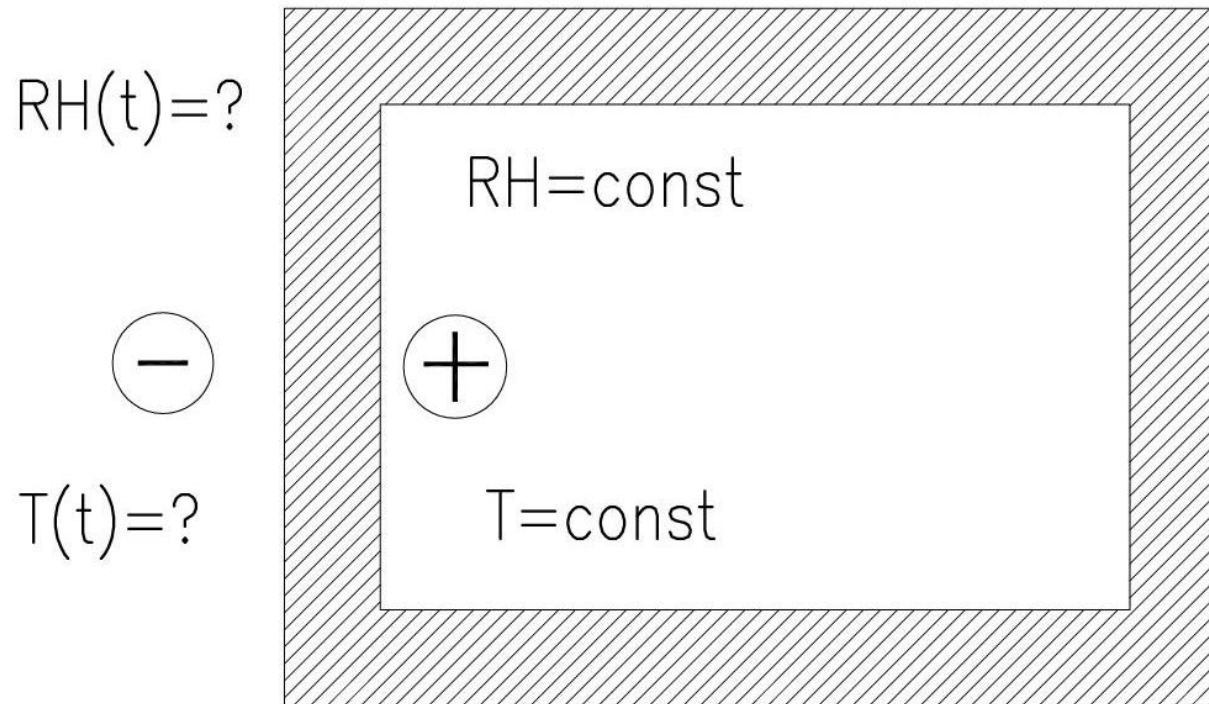-biological degradation and others.
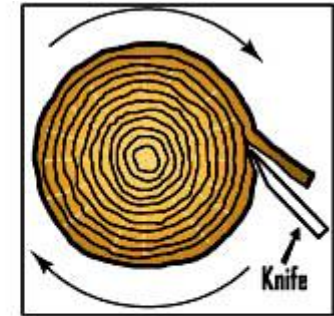
Research object

The aim of the work

The aim of the work is to obtain the non-uniform moisture influance on load bearing capacity of corrugated plywood shell.

Simulation methodology

Environment influence model

Environment influence model

Environment is simulated according to outside climate in Latvian (data taken from annex of building standard LBN 003-01).

Outside temperature and moisture is approximated by polynominals:

$$RH = 0.916 - 0.00326t + 1,68 \cdot 10^{-5}t^2 - 2.22 \cdot 10^{-8}t^3$$

$$T = -9.418 + 0.146 \cdot t + 0.000236 \cdot t^2 - 1.8 * 10^{-6} \cdot t^3$$

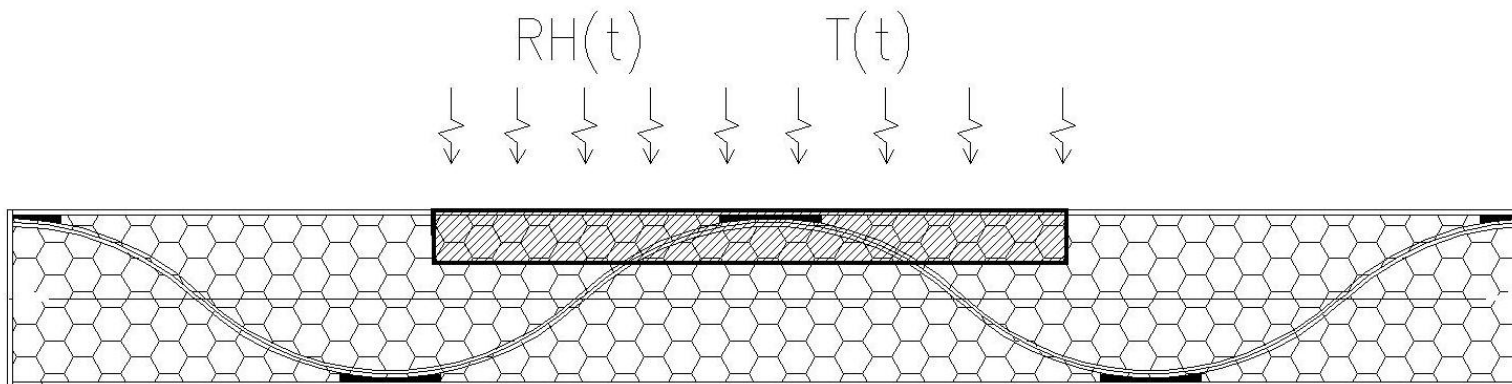Where t- time (hours), RH- relative humidity (dimensionless), T- temperature (C)

Moisture diffusion simulation

$$\frac{\partial m}{\partial t} = \frac{\partial}{\partial z}\left(D \frac{\partial m}{\partial z} \right)$$ Fiks law

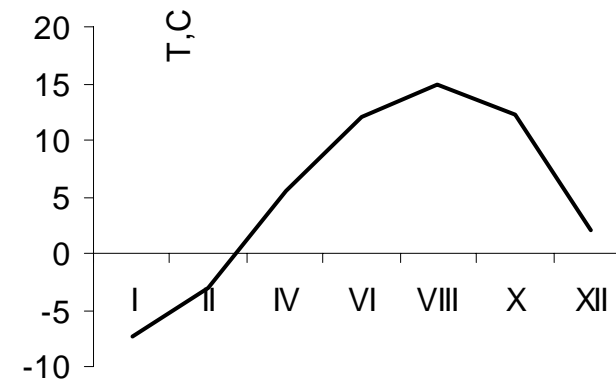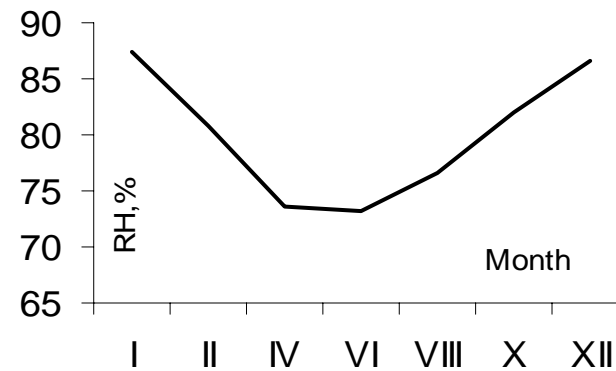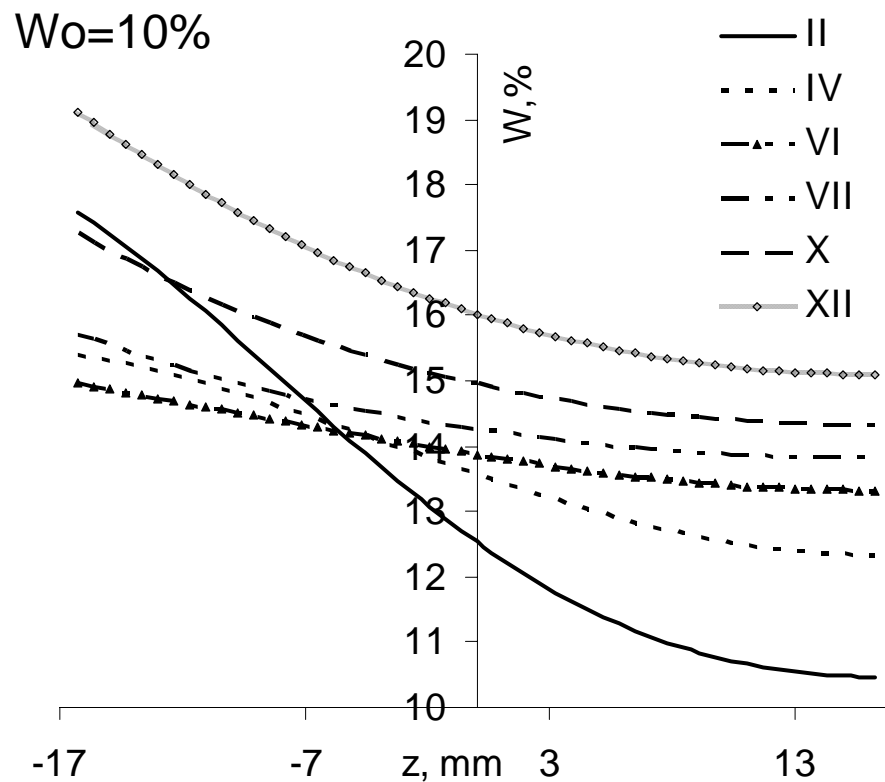$$D = 5.76 \cdot \exp\left(1.45 \cdot m - \frac{5280}{T} \right)$$

Where m- moisture content
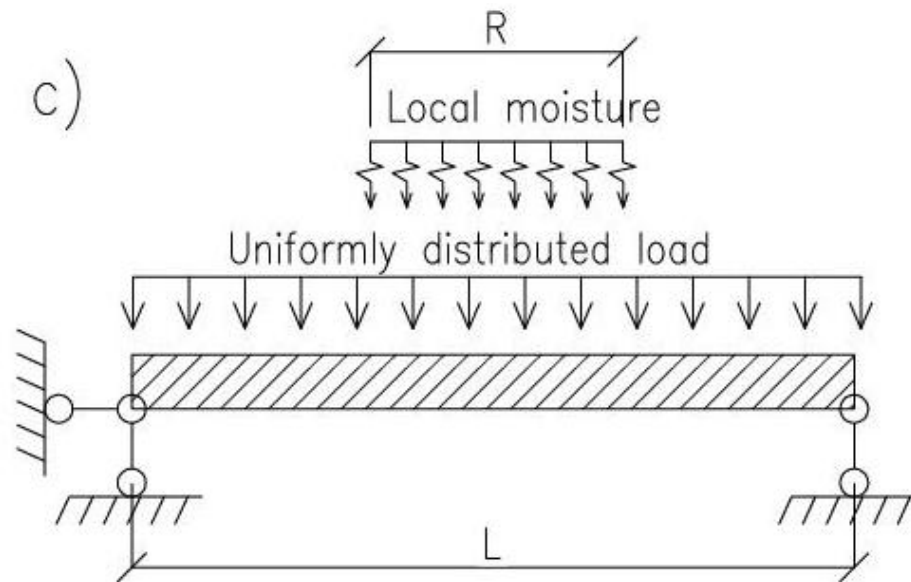t-time
D- moisture diffusion coefficient
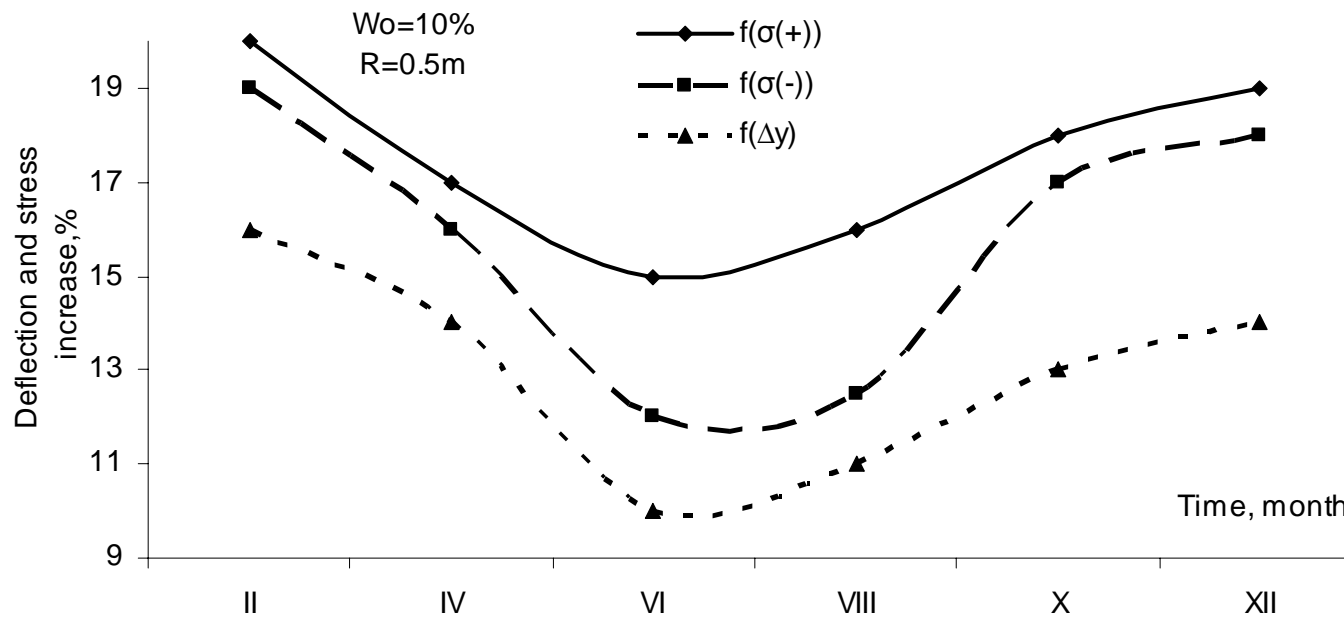T-temperature

Results of Moisture diffusion

Stress-deformation simulation
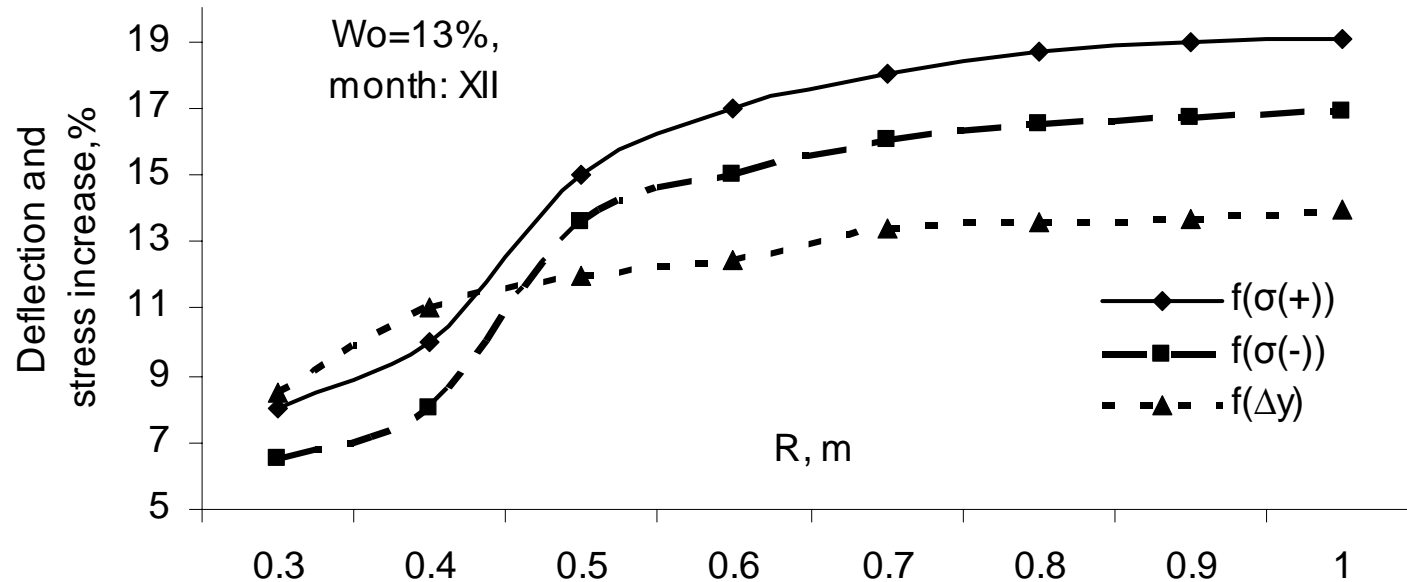
Simulation is done by
Finite element
method.

Results

Results

Conclusions

1. Methodology for prediction of decrease of load bearing capacity of corrugated shell element that is used as a main structural element in hybrid panel and affected by local moisture influence, taking into account history of environment moisture and temperature is proposed.
2. The moisture distribution curves of plywood corrugated shell element in hybrid panel by using isothermal moisture transport model that is based on Fick`s law and data of average relative air humidity and temperature courses in Riga are determined.
3. Time dependent decrease of load bearing capacity of hybrid panel that is affected by local moisture influence when structure has various manufacturing moisture content is obtained.
4. The research should be continued by making experimental investigations of local moisture influence on other plywood structure properties like decay, creep and its lifetime.

Thank You!

Questions!