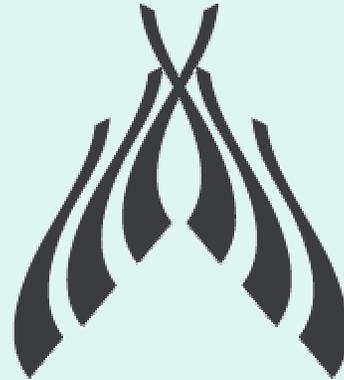




**SAFETY WITH SNOW AND ICE  
CONSTRUCTIONS**



Rovaniemen  
ammattikorkeakoulu  
University of Applied Sciences

Kai Ryynänen, Senior Lecturer, MSc(Tech)

# PRESENTATION DIVIDED:

SNOW AND ICE AS CONSTRUCTION  
MATERIAL

SAFETY IN CONSTRUCTION SITE

# SNOW MATERIAL

- DIFFERENT SNOW
  - NATURAL SNOW
  - ARTIFICIAL SNOW
    - MADE USING SNOW CANON ETC.
  - PROCESSED SNOW
    - SNOW PROCESSED MECHANICALLY BY STIFTING, BLOWING BY ROTARY BLOWS OR COMPACTING

# CALCULATIONS AND ESTIMATIONS IN SNOW STRUCTURES

- FOR EXAMPLE IN FINLAND IS MADE GENERAL RULES FOR DESIGN AND CONSTRUCTION
- CALCULATION IS "NORMAL" ENGINEERING WORK ONLY MATERIAL IS NOT KNOWN

- CALCULATION WHEN MADE LOAD-BEARING STRUCTURES
- SNOW DENSITY 400 – 800 KG/M<sup>3</sup>
- OVER 800 KG/M<sup>3</sup> IS SNOW ICE AND ICE

- PROPERTIES OF SNOW
  - LOW TENSILE STRENGTH
  - IMPACT OF WEATHER FACTORS WEAKENING AND WEARING THE STRUCTURE
  - INTENSE AND RAPID CREEP

$$q_{\alpha=0,9}^{1,2} \} g_k + 1,6 \cdot q_{k1} + 1,6 \cdot q_{k\text{sumi}(tuu\ddot{a})} + \sum 0,8 \cdot q_k$$

$$Q_d = g_k + q_{kl} + q_{klumi(tau_k)} + \sum 0,5 \cdot q_k$$

$$h_s = k_1 T_s + k_2 (1 - \beta) \cdot s \cdot Q_s$$

	DENSITY [KG/M3]	
PROSESSING OF SNOW	NATURAL SNOW	ARTIFICIAL SNOW
SNOW AS SUCH	100-200	300-400
HEAPED SNOW	200-300	300-400
-PROCESSING BY SNOW BLOWER OR A RIDDLE BUCKET	300-400	400-500
.MULTIPLE PROCESSING AND COMPACTION	400-600	500-700
-PROCESSING, COMPACTION AND ADDITION OF WATER	-800	-800
- INCREASE IN DENSITY WHEN COMPACTING BY TREADING	50-100	50-100

# ICE AND SNOW ICE

- ICE AND SNOW ICE IS ALMOST SIMILAR THAN SNOW
  - MOLECYL STRUCTURE IS DIFFERENT
  - IN FINLAND IS NO RULES FOR ICE AND SNOW ICE CONSTRUCTIONS
  - TODAY STRUCTURES ARE MADE BY TRIAL AND ERROR

# SAFETY IN CONSTRUCTION

- Normal construction site – normal "rules"
  - Use scaffolding/cradle when high structures (over 1,5 m from ground)
    - Safety fence
  - Use ladder (specially folding ladder ?)
  - Snow and ice make ground very slippery
  - "dangerous" tools
    - Chain saw
    - Special tools

- Moulds
  - Wood
  - Plastic balloon
- Electric in snow and ice
  - Electric tools (chain saw, drills etc.)
  - Electric cables and connections
    - In Finland IP54 class

– Lights in snow and ice

- Halogen lamps
- Led lights
- Where put optical projector?
- Etc.

# Machines vs. human

- Loader
- Lorries
- Tractors
- Excavators
- Snowblower
- etc.



















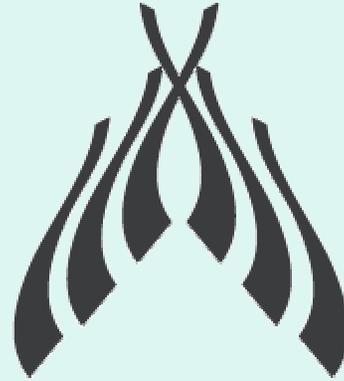












**Rovaniemen**  
**ammattikorkeakoulu**  
University of Applied Sciences

**Kai Ryynänen, Senior Lecturer, MSc(Tech)**  
email: [kai.ryynanen@ramk.fi](mailto:kai.ryynanen@ramk.fi)