Aalto University
School of Engineering

REHVA TG:
Displacement Ventilation Design Guide

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Status of the project

- Internal review comment on 23.9
- Updated version ready on 30.9
- Final Skype of TG on 4.10
- Ready for review process and Figures improvement on 14.10

Contents of the Guide

REHVA Displacement Guide		
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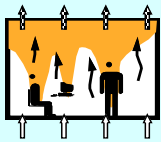
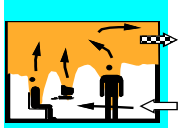
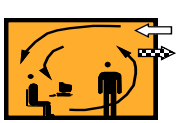
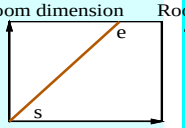
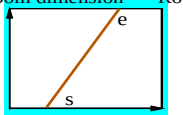
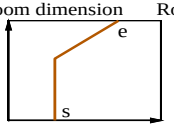
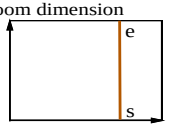
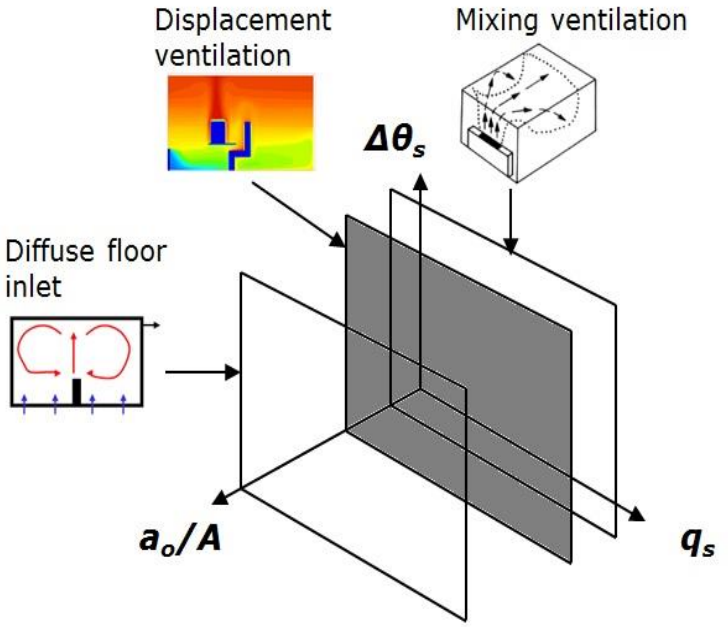
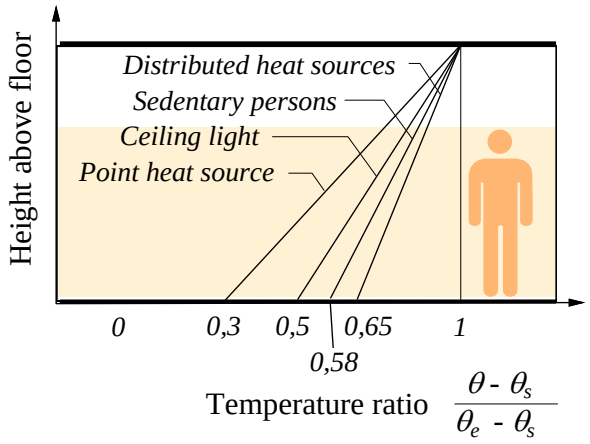
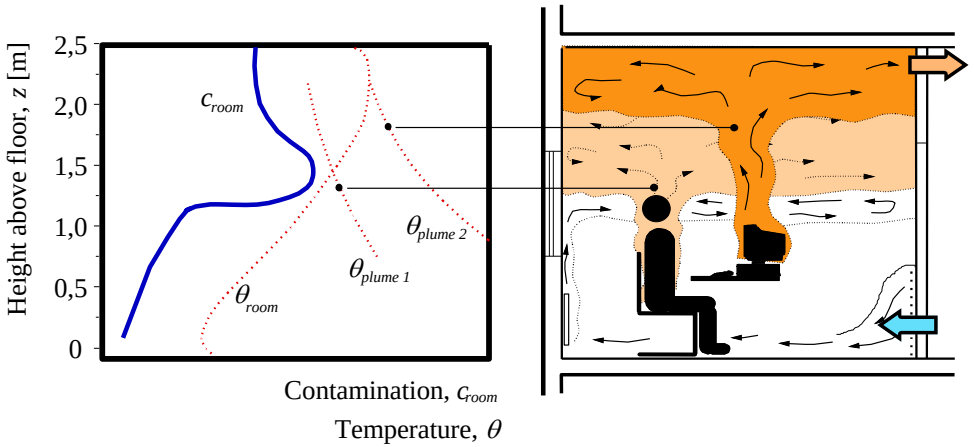
Space Air Conditioning

Strategy	DISPLACEMENT PISTON	DISPLACEMENT STRATIFICATION	ZONING	MIXING
				
Description	Unidirectional flow through the room	Utilise density differences	Air flow from clean zones to contaminated zones	Uniform conditions in all parts of the room
Air quality; · temp, θ · humidity *RF* · contaminants, *c* s = supply e = exhaust	Room dimension  *θ, RF, c*	Room dimension  *θ, RF, c*	Room dimension  *θ, RF, c*	Room dimension  *θ, RF, c*
Main characteristics	Flow pattern controlled by low momentum supply air, strong enough to overcome disturbances	Flow pattern controlled by buoyancy	Flow pattern controlled partly by buoyancy and partly by supply air momentum	Flow pattern controlled by high momentum supply air
Ventilation effectiveness	$\varepsilon_\theta = \frac{\theta_e - \theta_s}{\theta_{oz} - \theta_s}$ $\varepsilon_c = \frac{c_e - c_s}{c_{oz} - c_s}$ ∞ ⟵ ⟶ 1			

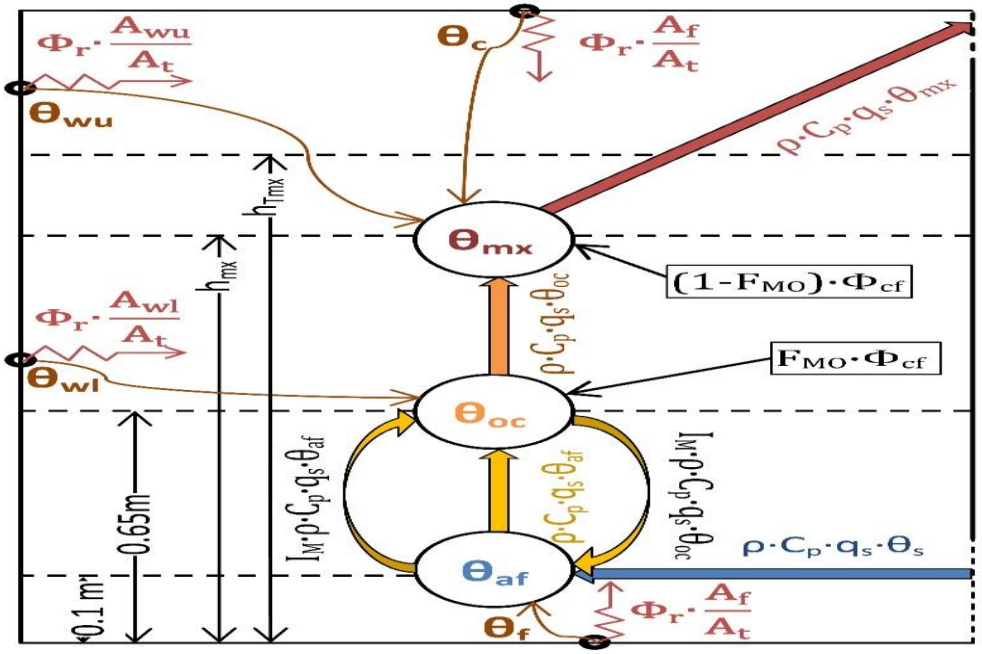


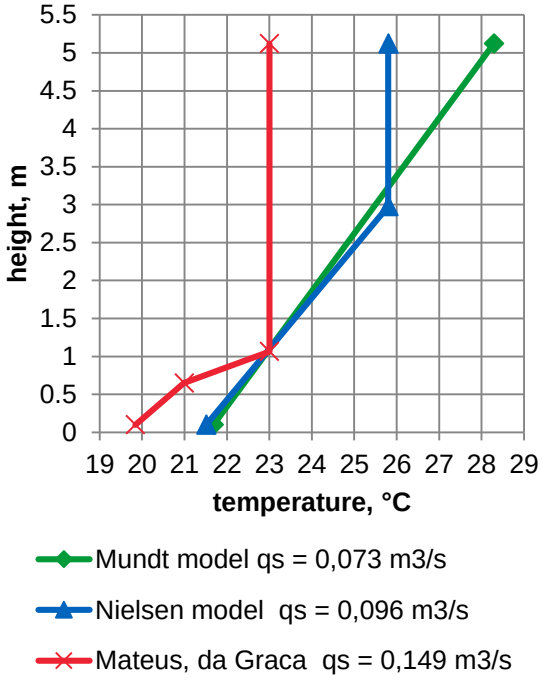
Performance of displacement ventilation



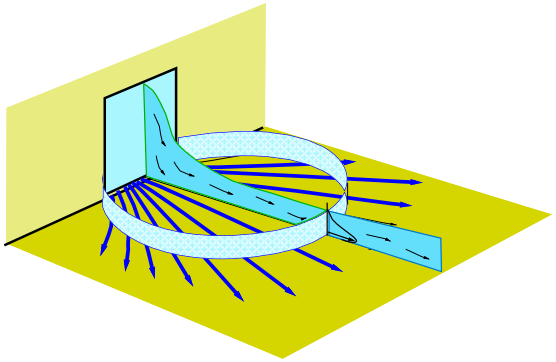


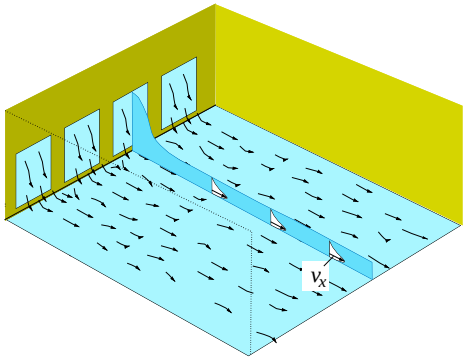
CALCULATION OF SUPPLY AIRFLOW RATE

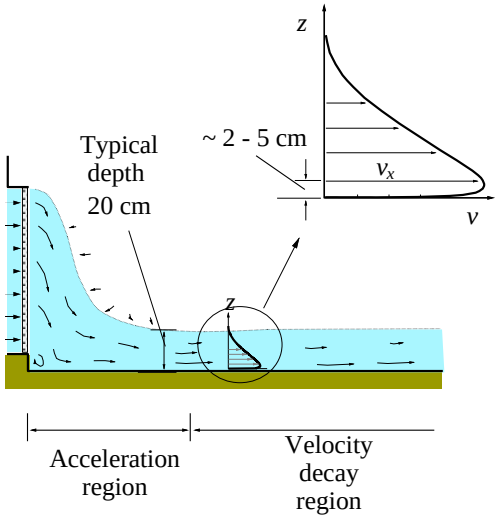


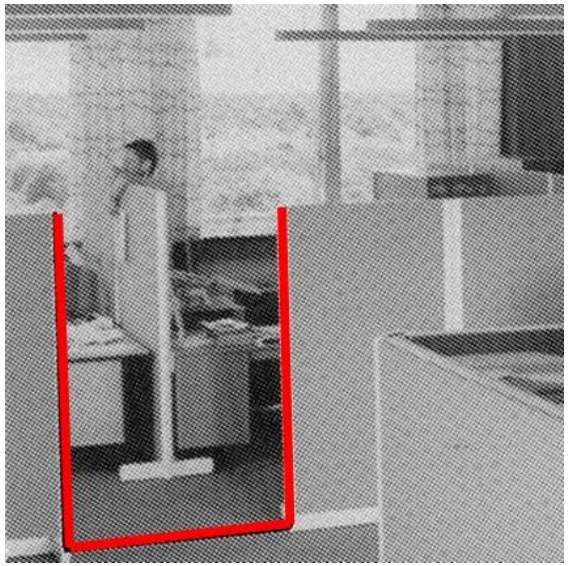


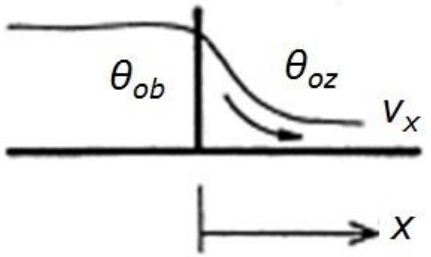
AIR DIFFUSERS FOR DISPLACEMENT VENTILATION



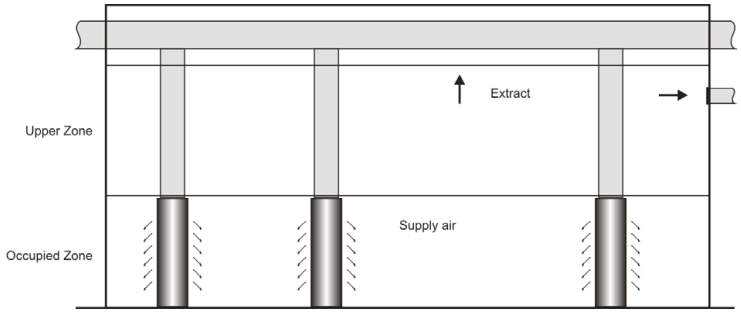




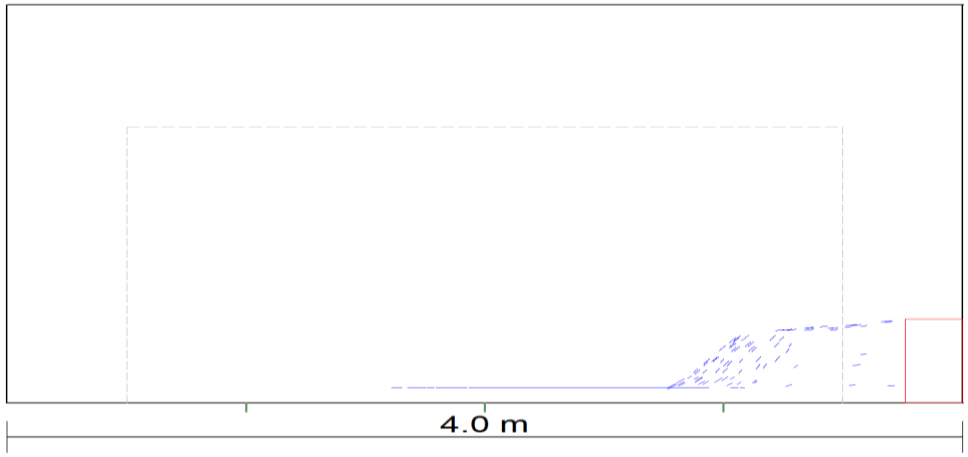




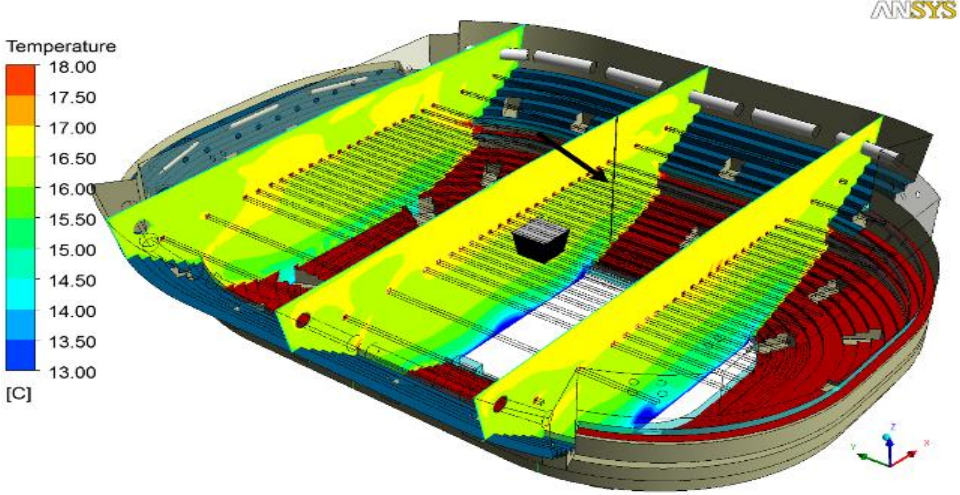
DESIGN OF DISPLACEMENT VENTILATION

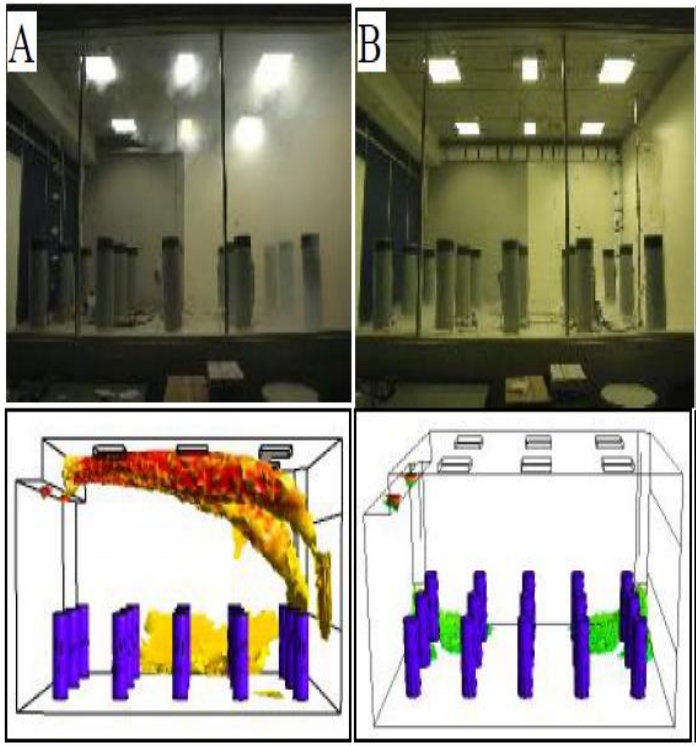


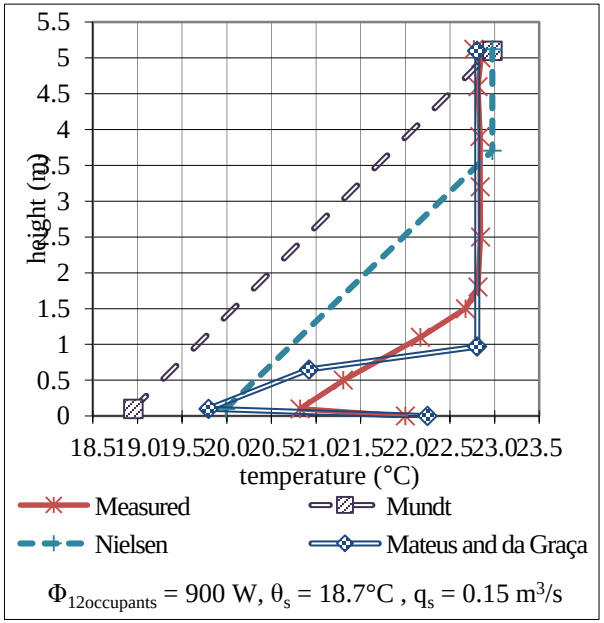
Room:		Supply air flow rate	40 l/s
Room size:	4.0 x 3.0 x 2.6 m		3.3 l/(sm²)
Occupied zone:	h=1.8 m / dw=0.5 m	Supply air temperature:	18.0 °C
Room air:	24.0 °C / 55 %	Total pressure drop:	11 Pa
Heat gain:	-	Unit sound pressure level:	15 dB(A) 10m²sab
Calculated air flow:	-	Total sound pressure level:	14 dB(A)
Location	Near zone (nz)	Isovel 0.30 m/s (iv30)	Isovel 0.20 m/s (iv20)
Throw length	1.0 m	1.4 m	2.6 m
dt (supply air - room air)	2.8 °C	2.0 °C	1.1 °C



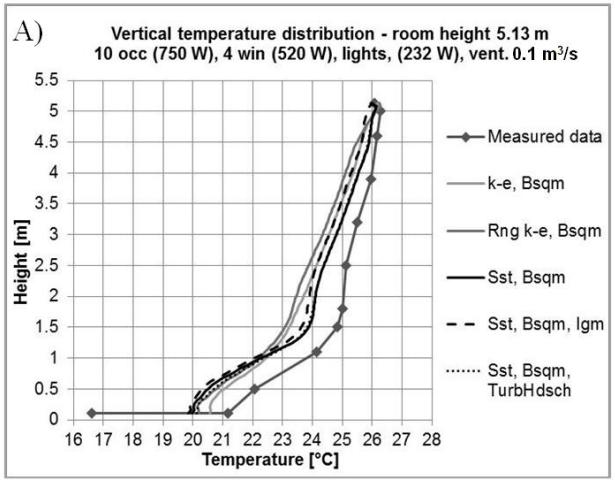
case studies

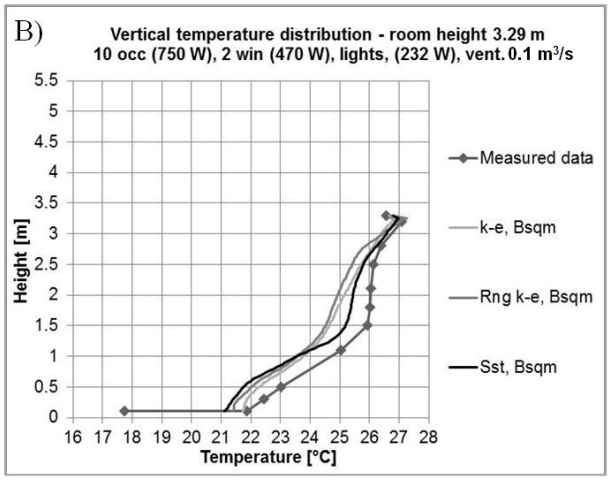


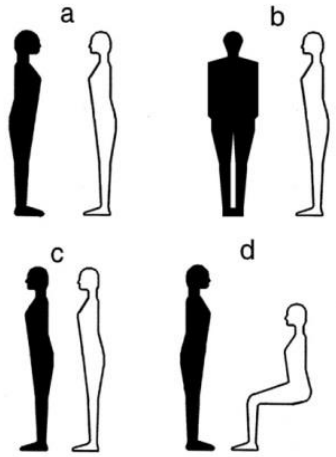


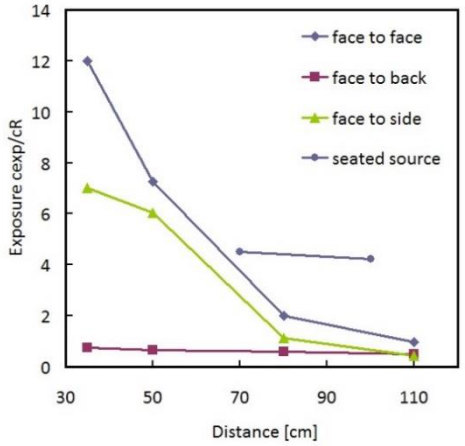


RESEARCH FINDINGS









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