The indoor climate and ventilation of Elderly homes

TEET-ANDRUS KOIV, HENDRIK VOLL, ALO MIKOLA, DMITRI LUKJANOV
Department of Environmental Engineering
Tallinn University of Technology
Ehitajate tee 5, 19086 Tallinn
ESTONIA
teet.koiv@ttu.ee

Abstract: - The paper presents the results of the investigations into the indoor climate in elderly homes. The purpose of the study was to examine the performance of single-room air handling unit. The study indicated that this engineering solution is suitable for elderly homes. Results of measuring show us that CO₂ concentration in rooms were predominantly lower than II class of standard EVS-EN 15251:2007. Measuring results conducted in different rooms show us that room air handling unit with heat recovery ensure good indoor climate in Elderly Home.
To guarantee the good indoor climate conditions in rooms high level adjusting is necessary. The new arrangement might become favorable technology when designing the elderly homes.

Key-Words: - Indoor climate, Elderly home, Room air handling unit, CO₂ concentration in rooms, Cumulative distribution of relative humidity, Cumulative distribution of CO₂ concentration in rooms

1 Introduction
Recently more and more attention on questions of indoor climate and ventilation was turned in homes for elderly people.
The paper [1] provides an overview of the indoor environmental parameters, as well as the integrated design and implementation of relevant building systems. Results are presented as indicators of the basic value, functional value and economic value, as well as a synthesis of building-related solutions. Results can help designers and building services engineers to create optimal environmental conditions inside the living environments for people with dementia. According to Aminoff [2], poor indoor environmental quality may have a role in the suffering of people with dementia. Good design calls for an integrated approach. The integrated design of buildings for elderly people in itself is a complex process; involving numerous stakeholders, disciplines and building systems, which aims at creating a range of stakeholder-related values or benefits [3]. This combined model was first presented in van Hoof et al. [1]. Such a combined framework is needed as this study tries to bring together demand and supply, namely the needs of the stakeholders and the solutions offered in the field of construction and technology.

Variety of articles deal with problems of indoor climate in residential buildings where conditions are similar as in homes for elderly people.

In paper [4] is marked that thermal comfort is ranked by building occupants to be of greater importance compared with visual and acoustic comfort and good air quality. It also seems to influence to a higher degree the overall satisfaction with indoor environmental quality compared with the impact of other indoor environmental conditions. In the paper [6] marked that thermal sensation of elderly people is different comparing with younger people.

Kong Analyses of indoor climate is made in lot of apartment buildings, i.e. in nine Chinese cities [7] and in Hong Kong [8].
The indoor climate of apartment buildings was widely investigated in Tallinn University of Technology [9,10,11].

In current paper indoor climate is thoroughly studied in different rooms in Elderly Home of Alutaguse, Fig. 1, with room air handling unit (AHU) with heat recovery, Fig. 2 and 3.
2 Method
The investigation of indoor climate, relative humidity and CO$_2$ concentration is carried out in rooms of one and two people, the results are compared with standard of indoor climate [12]. The temperature, the RH and CO$_2$ level in the rooms were measured with data loggers at 10 min intervals. The temperature range measured by the data loggers was between -5ºC and +30ºC with an accuracy of ±0.35ºC and the RH range was between 5% and 95RH% with accuracy of ±2.5RH%.

3 Results
The investigations of indoor climate were carried out in period of 15 April to 22 April in 2011. Sensors and loggers were installed in rooms 180, 182, 186 and 193. In the room 180 is lived one old woman, the same is in the room 182. In the room 186 live two women and in the room 193 live two men.

Indoor temperature and relative humidity logging results in different rooms of Elderly Home is presented on Fig.4 and 5.

![Fig.1 Room air handling unit (AHU) with heat recovery in room and Elderly Home of Alutaguse](image1)

![Fig.2 Room air handling unit with heat recovery](image2)

![Fig.3 Room air handling unit with heat recovery](image3)

![Fig.4 Cumulative distribution of indoor air temperature in different rooms of Elderly Home](image4)

![Fig.5 Cumulative distribution of relative humidity of indoor air in different rooms of Elderly Home](image5)
The recording results of CO2 concentration in different rooms of Elderly Home is presented on Fig.6, 7, 8 and 9.

Fig.6 Cumulative distribution of CO2 concentration in different rooms of Elderly Home

Fig.7 CO2 concentration in different rooms, air change 24.4 m³/h

Fig.8 CO2 concentration in different rooms, air change 33.9 m³/h

Fig.9 CO2 concentration in room nr 180 with different air change

Results of measuring show us that CO2 concentration in room were predominantly lower than II class of standard EVS-EN 15251:2007. With air change 33.9 m³/h CO2 concentration in 2 rooms were lower than I class of standard EVS-EN 15251:2007, in one rooms was on the level of I class of standard EVS-EN 15251:2007 and in one room between the levels of 1st and 2nd classes.

Measuring results conducted in different rooms show us that room air handling unit with heat recovery ensure good indoor climate in Elderly Home. Rational organization of ventilation significantly contributes to energy savings.

Investments on ventilation with room air handling unit with heat recovery are close to them with central balanced ventilation system. In the same time running costs of ventilation with room air handling unit is significantly lower than with central balanced ventilation system.

4 Conclusions

Investigation into indoor climate in Elderly Home of Alutaguse was carried out in rooms with room air handling units with heat recovery. The results of study show that new ventilation solution is perfectly suitable for ventilating rooms of elderly home. Tests carried out in different rooms show that necessary indoor air conditions are possible to ensure with relatively simple devices. While investment is close to those to central balanced ventilation systems. If the investments of room AHU are close to those in central balanced ventilation system, the running costs are significantly lower than those in central balanced ventilation systems. Rational arrangement of ventilation allows significant energy savings.
References: