Better bicycle helmets for commuters – evaluation of ventilation

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Introduction

- According to the VTI (the Swedish National Road and Transport Research Institute) the number of bicycle helmet users stays over the years relatively stable around 20 %.
- In Europe the number of helmet users varies between 1 and 40 % depending on country.
- Research has shown that the use of helmet is effective in reducing impact energy in the case of traffic accidents.
- In spite of that it is not fully clear what are the main factors why only a small amount of bicyclists use the helmet.
- In our previous paper we identified thermal aspects, e.g. issues related to ventilation in helmets as one of the causes of not using the helmet.
- The target groups were identified and parameters affecting ventilation in helmets identified.

Aims and objectives

- The major aim of this study was to create bicycle helmets that allow better thermal comfort than the presently available solutions.
- A secondary aim was to acquire helmet mock-ups that can be modified for studing the possibilities of the solutions.

Methods

- A group of students got an introductory lecture on thermal aspects related to bicycle helmet.
- 16 design students of Estonian Academy of Arts chose the topic for their project course.
- The aim was set to 1:1 mock-up of a new helmet solution.
- Supervision throughout the design process was given by a design and a thermal environment specialists.
- The students were guided to solve heat/ventilation problem with possible different approaches.
- A limitation to be kept in mind was that the helmet is a protective device.
- All helmets were tested at the Thermal Environment Laboratory:
  - Wind tunnel air velocities 0.2, 1.6 and 6.0 m/s
  - Thermal head manikin
  - Wig (hair) vs. no wig at 1.6 m/s

Results and discussion

15 design solutions were created (TKo is TK set on head rear to front). The created mock-ups allow for modifications. The mock-ups together with modification allow search for the best solution. All helmets were tested for ventilation and more than half of them functioned better than the ones on the market and/or tested earlier. The results can be seen in Figures 4-8. Various solutions allow best fit with low speed, high velocity and hair style. There is no unique “best solution” - this would allow customisation to specific user needs.

Figure 1. New bicycle helmet concepts.

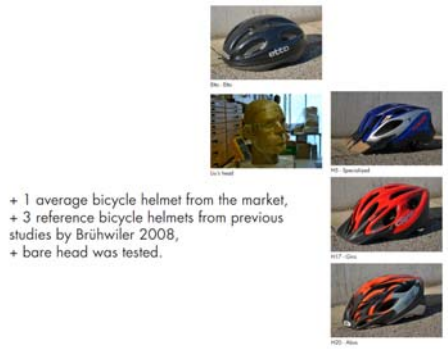

Figure 2. Additional, on the market available helmets.

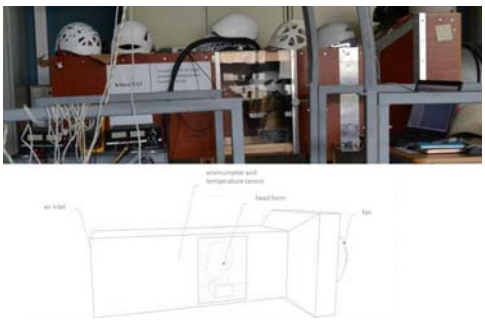

Figure 3. Experimental setup.

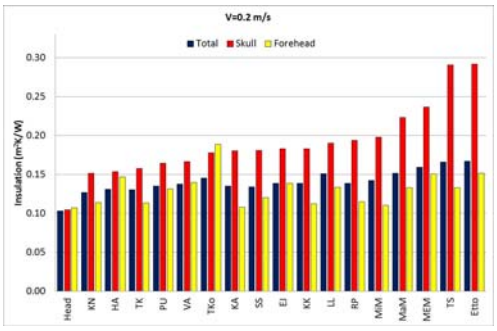

Figure 4. Helmets’ insulation at air velocity 0.2 m/s.

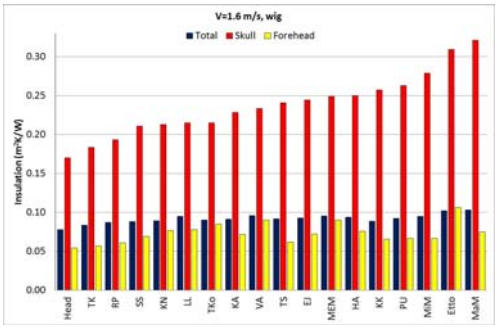

Figure 5. Helmets’ insulation at air velocity 1.6 m/s with wig.

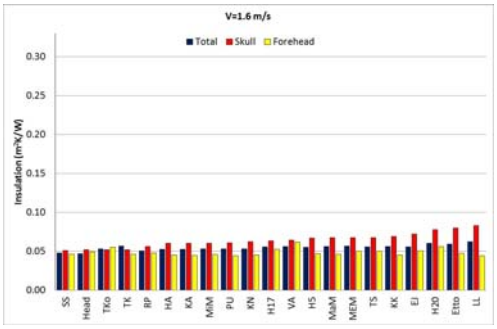

Figure 6. Helmets’ insulation at air velocity 1.6 m/s.

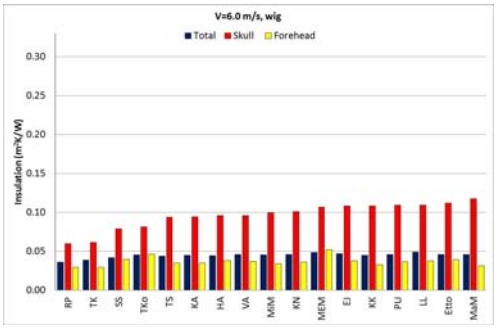

Figure 7. Helmets’ insulation at air velocity 6.0 m/s with wig.

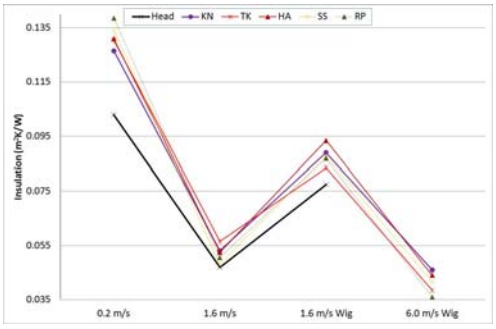

Figure 8. Insulation change in specific helmets.

Future work

- The work will be continued by modification of some mock-ups according to new ideas, in order to see if any change would improve or lower the performance.
- As sweating is a natural way of human temperature regulation then evaporation tests are needed.
- Further, the best solutions will be chosen, and the design work with considering of impact testing will be continued.

Acknowledgements

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http://www.eat.lth.se/termisk_miljoe/english