Description of the problem Footwear selected to be used in the mine work is normally based on the risk assessment because some workers do occasionally work that includes welding the footwear are selected on those based on those criteria's. Most commonly the footwear soles are selected so that they are resistant to hot contact (HRO) according the PPE-footwear standard. This leads to the selection of footwear which sole are made from dense materials like nitrile rubber. Using of those dense polymers like can be problematic in the arctic area because the slip resistance of the footwear soles made from dense materials is found to be poorer than footwear made from softer soling materials. The cold climate can increase the hardness of the soling material which makes footwear even more slippery.

Slip resistance, i.e. dynamic coefficient of friction (DCOF) of the footwear was measured in laboratory by using FIOH's own laboratory device slip simulator. Measurements were carried out according the parameters defined in the standard EN ISO 13287: 2012 Personal protective equipment-Footwear-Test method for slip resistance. The standard method was modified only by using smooth ice surface as a test surface. Ten consecutive measurements were done by each footwear model. The mean value and standard deviation was calculated. In addition the footwear was pre-conditioned in the climatic chamber at the temperature of –20 C° for four hours in order to see how the hardening of the sole materials affects to the slip resistance. Hardness of the sole was measured by using hardness tester with Shore (A) hardness scale.

Four different footwear were selected and collected form the mines participating in the project. Three of those footwear were safety footwear according EN ISO 20345: 2011 they were half-knee height leather footwear designed for winter conditions. One sample was rubber boot from Russia and it was not classified as safety footwear according to EN or ISO standards. Additionally six different safety footwear for winter conditions were selected in order to compare level of performance the slip resistance of footwear used in mines to the winter footwear available in the market.

Results Samples collected from the four mines got almost equal DCOF levels than the winter safety footwear selection from market when they were measured without pre-conditioning, but the DCOF values were 39% lower compared to winter safety footwear selection when the samples were pre continued in climatic chamber. Hardness of the footwear sole increased 26% in average because of the pre-conditioning in cold.

Conclusions Footwear currently used in the four mines have reasonable good slip resistance compared to footwear's available in the market, but their fiction level is strongly dependent of the temperature. For safety reasons, it would be advisable to use footwear sole materials which are not so much affected by the temperature changes especially in the artic area mines.

635 PHYSICAL STRAIN OF MAST AND POLE WORK IN ARCTIC CONDITIONS

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Background Since physical strain during mast and pole work is not known this study evaluated the level of muscular, cardiorespiratory and thermal strain of mast and pole workers with special emphasis on arctic conditions, winter.

Methods Fourteen voluntary mast and pole workers participated. We measured their muscular strain using electromyography, expressed as percentage in relation to maximal EMG activity (% MEMG). We estimated VO_2 from HR measured during work (using individual VO_2-HR relationship) and expressed it as% VO_2max. To quantify thermal strain skin and deep body temperatures were measured using temperature sensors and telemetric pill and receiver.

Results We found the highest average muscular strain in the wrist flexor (24 ± 2% MEMG) and extensor (21 ± 1% MEMG) muscles, exceeding the recommendation of 14% MEMG. Average cardiorespiratory strain was 48 ± 3% VO_2max. Nearly half (40%) of the subjects exceeded the recommended 50% VO_2max. Winter condition increased both muscular and cardiovascular strain on average by 4 and 2%, respectively. Deep body temperature varied between 36.8 and 38.0 °C and mean skin temperature between 28.6 and 33.4 °C. Cooling was most pronounced in extremities during winter. Lowest single temperatures in middle finger, hand and big toe varied between 6.4 and 18.5, 9.4 and 24.9 and 15.4 and 24.6 °C, respectively.

Conclusions This field study showed that workers may be at risk for local and/or systemic muscular and cardiorespiratory overloading (the winter enhancing this effect) and thus for excessive fatigue, reduced work efficiency and increased risk for musculoskeletal symptoms. Generally, thermal strain remained at a tolerable level.

636 STAY STANDING – WINTER SAFETY CAMPAIGN FOR PEDESTRIANS

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Background Stay Standing – Winter Safety Campaign for Pedestrians is part of the Implementation Project on Prevention of Home and Leisure Injuries. SOSTE Finnish Federation for Social Affairs and Health is the chairman of the campaign and Finnish Red Cross is coordinating the entire project. Partners in the campaign include various non-governmental, governmental and private organisations. Partners are working in the fields such as injury prevention, traffic safety and weather and climate conditions.

Description of the problem Each winter every four out of ten of the Finns (total population 5.2 million) are slipping due to icy weather conditions. Half of them get injured. Slipping causes plenty of minor injuries. Slipping also causes severe injuries such as fractures, dislocation of joints and head injuries, which may lead to long term disability. Each year more than 5000 people are hospitalised overnight during icy or snowy weather conditions. Slipping does not vary among the adult age group.

Results The Campaign promotes safety through informing the associated risks, which rise throughout the winter. The campaign also provides information on risk reduction. January is the most active month of the campaign. The target group is chosen each year. Also, different communication channels for the campaign are chosen each year: TV-spots, radio, digi screen, printed material and seminars.

Conclusions Conducting the campaign in collaboration with various governmental and non-governmental organisations has been very useful. By effective communication, the campaign has

equipped pedestrians the means in improving their safety during icy weather conditions.

637 ROAD SAFETY EDUCATIONAL MATERIAL BASED ON OCCUPATIONAL HEALTH AND SAFETY EDUCATION METHODS

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Background Learning from accidents is an important method for improving safety. In Finland, fatal occupational accidents are investigated. The data from the investigations is used for statistical purposes, but also to create occupational accident cases that are used for accident prevention.

Fatal road accidents are also investigated. Due to legislation, the method used for analysis is different than in occupational accidents. The data is published as statistics, but the case information is not published, although road accident cases would also be important for improving road safety.

Objective The aim of this project was to produce case-based educational material on road accidents for heavy traffic professionals. The material was produced in the same format as the accident investigation cases created for occupational accidents.

The data was gathered by the Finnish Motor Insurers´ Centre. The first set of data included 10 selected fatal accidents from 1993 to 2009. The second set included 32 accidents that led to the death of the driver in a heavy vehicle from 2011 to 2013.

Results The 10 cases were edited into safety case materials and published as slide shows in 2013. The materials included short introductions to each case, background information on the accident, risk factors, and tools or ideas for avoiding similar accidents. The material was available for four teachers who used it in vocational education. The feedback was positive.

The second set of materials included three theme studies, each including several accident cases. Reports can be used by teachers or vocational education providers.

Conclusions Both materials are usable as learning material. The theme studies are available on an open access web page (http://totti.tvl.fi). Currently the material is only in Finnish. Case investigations about fatal occupational road accidents have not yet been published in this series, but procedures will be developed in order to conduct case investigations in the future.

638 EFFECTIVENESS OF THE HSEQ TRAINING PARKS

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Background The HSEQ Training Park concept is a unique safety innovation by which different actors of the construction industry and other branches can be trained on practical level to perform different work phases safely at construction sites. There are currently two training parks in Finland (in Espoo, founded 2009 and in Oulu (Northern Finland), 2014). The hypothesis is that the participating construction companies (and other stakoholders) in Finland benefit on this kind of participatory training approach and that the improvement can also been verified by using quantitative indicators. The main goal for this study is to survey the effectiveness of the training park trainings in Oulu and in Espoo. The study time is from February 2015 to February 2017. Three work packages have been formed: 1) Effectiveness in Oulu training park (note that only 1–2 years of activity) 2) Effectiveness in Espoo training park (somewhat 6 years of activity) 3) A design science approach to formulating a common safety measurement criteria for member stakeholders of Turvapuisto Northern Finland (appr. 70 different stakeholders).

Methods This study is based on design science premises, i.e. the aim is to provide up-to date and valid information that can be used for improving current training parks and reasoning (or unreasoning) new training park initiatives. In order to study such a complex issues we have needed to have a multidimensional approach with both qualitative and quantitative measures. A realistic evaluation was chosen as the methodological framework for this study, as it allows such multidimensional approaches and as it has been utilised earlier in different OSH studies. We have used the Nordic Safety Climate Questionnaire (NOSACQ-50) and the focus group discussion method when studying the effectivness of training parks in six companies.

Results The preliminary results of the NOSACQ study shows that before the visit/training in the HSEQ Training Park the seven dimensions were on average at following level (min 1, max 4): 1) management safety priority, commitment and competence: 3.43 (min 3.14, max 3.73), 2) management of safety empowerment: 3.32 (min 3.08, max 3.69), 3) management safety justice: 3.39 (min 2.90, max 3.77), 4) workers' safety commitment: 3.45 (min 3.18 max 3.73), 5) workers' safety priority and risk non-acceptance: 3.34 (min 2.99, max 3.73), 6) safety communication, learning, and trust in co-workers' safety competence: 3.38 (min 3.22, max 3.72), 7) workers' trust in the efficacy of safety systems: 3.53 (min 3.22, max 3.81). The focus group discussions pointed out the different matters in safety training which should be taken into consideration and how the HSEQ Training Parks should be developed.

Conclusions If occupational safety in the construction industry is to be improved, new innovative concepts for safety management and training are needed. Construction work is done in work environments in which employees cannot be continuously supervised. Thus in many cases, employers must place their trust in their employees' ability to perform work safely in all circumstances. Holistic, systemic safety training is one way in which to enhance employees' abilities and knowledge regarding this topic. The concept of the HSEQ Training Park as a new novel safety training innovation has been introduced in Finland. The construction process of the Training Park in Oulu shows how rival companies can jointly develop new kinds of practices when all stakeholders have a common interest in accident-free construction sites. Several educational institutions and organisations in Northern Finland have adopted Training Park training into their curriculums. Numerous new idea regarding future needs for training practices and development activities have been raised, for example, during the Training Park construction phase and in the trainer training sessions, and in organisations' and communities' own training sessions. These thoughts include a willingness to ensure that the construction industry's SMEs also apply Training Park training in their safety management practices. New practices for these purposes are planned for execution in the next few years.

This study presents the preliminary results from the NOSACQ distributed in the representatives of the six companies participating in the study. The seven dimensions which were studied were at quite high level already before the training in the Training Park. The paper will present the results in more details, e.g. the