during carrying weight was consistent with the body's response to an increase in braking force/power and contact time. Carrying a weight was associated with an increased probability of slip ($p < 0.004$, OR = 2.0). Wearing a rubber boot led to an increased probability of fall ($p < 0.02$, OR = 5.7).

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ASSESSMENT OF REPETITION IN AUTOMOTIVE ASSEMBLY JOBS.
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The American Conference of Governmental Industrial Hygienists has published a Threshold Limit Value (TLV) for repetitive work. This TLV uses a metric, the Hand Activity Level (HAL), which relates repetition to exertion frequency and duty cycle. The HAL can be determined using an observational scale with verbal anchor points or through a calculation using duty cycle and exertion frequency. The aim of this study was to compare the observational and calculation methods. Over 500 automotive assembly jobs with a cycle time of approximately one minute were assessed by a pair of analysts using a visual analog scale. From these jobs, 25 were selected to maximize the range of HAL values. An independent analyst was then chosen to calculate the exertion frequency and duty cycle of the subset of 25 jobs using a fixed interval sampling method. This method required the analyst to observe the video at 0.25-s intervals and assess hand force. An exertion was defined as "a conspicuous increase in hand force." The duty cycle was defined as the percent of time the worker's hand force was greater than 2.5%. A paired t-test between the observed HAL rating and the calculated HAL value showed that there was a statistical difference between the two samples ($p = 0.01$). When a linear regression was performed, the analysis showed a correlation between the two samples ($r = 0.44$). While the two values are significantly different, there is a general trend that both follow. The calculation method tended to underestimate the HAL when compared to the observational method with an average difference of 1.6 pts on a 10-pt scale. In addition, the calculation method did not accurately depict jobs with a low exertion frequency and high duty cycle.

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INDIVIDUAL CAPABILITIES ASSOCIATED WITH THE PERFORMANCE IN THE JOB-RELATED TEST DRILL FOR FIRE FIGHTERS.
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Objective. The best way for occupational health and safety personnel to evaluate the physical work capacity of fire fighters is the job-related test. The test needs to be reliable and safe. The objective of this study was to identify individual capabilities, which are associated with the performance in the job-related test drill developed for fire fighters for evaluating their physical work capacity. **Methods.** Forty-eight male fire fighters aged 30–54 years performed a job-related test drill including five typical fire-fighting tasks: walking with two rolls of hose (ca. 32 kg), stair climbing with two hose carriers (ca. 36 kg), hammering, going over and under bars (height of 60 cm), and hose rolling. The drill was carried out as rapidly as possible using proper work techniques and wearing fire protective clothing and equipment (ca. 26 kg). Anthropometrics, cardio-respiratory capacity, and muscular fitness were measured in the laboratory. Performance time, heart rate (HR), oxygen consumption (VO_2), and ratings of perceived exertion (RPE) were assessed in the drill. **Results.** The mean performance time was 10.5 min, and respectively HR, VO_2, and RPE were 163 beats/min, 2.52 l/min (22.9 ml/min·kg-1), and 15. The results obtained in the squatting (40 kg, repetitions/min), bench press (40 kg, repetitions/min), and pull-up (maximal repetitions) tests correlated significantly (-0.42, $p = 0.009$; -0.39, $p = 0.020$, and -0.43, $p = 0.009$, respectively) with the performance time. Correspondingly, the significant correlations were observed between the absolute maximal VO_2 (-0.50, $p = 0.002$) and the maximal VO_2 related to body mass (-0.42, $p = 0.010$) and the performance time. **Conclusions.** Good cardio-respiratory capacity and muscle endurance and strength were associated with short and successful performance time in the job-related test drill. However, further development, also for safety reasons, is needed to reduce the static and to increase dynamic workload in the drill.

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EFFECTS OF CONSTRUCTION STILTS ON GAIT CHARACTERISTICS AND JOINT LOADINGS.
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Falls and overexertion are the leading causes of traumatic injuries in the construction industry, largely attributable to the nature of construction work, which continually requires workers to maintain awkward postures and perform tasks at elevations. Stilts are elevated equipment commonly used for drywall finishing, painting, and ceiling work. Previous researchers suggested that stilts may place workers at increased risk for knee injuries and falls. This study was undertaken to quantify stresses and changes in gait biomechanics associated with stilts. Ground reaction forces and body dynamics of 20 subjects (age: 35.8 ± 7.7 years) were evaluated during walking with stilts at different heights (24 or 40 inches). Subjects walked on different paths (straight or curved) with or without holding a mud pan and a trowel in hands. Results from repeated measure ANOVA revealed significant gait adaptations associated with stilts, including increases in stride length, step width, stride period, and reductions in velocity at heel contact ($p < 0.0001$). Furthermore, lower extremity joint moments (peak ankle dorsiflexion, knee extension, and hip extension) were significantly affected by stilt height ($p < 0.001$). As the height of the stilt increased, lower extremity joint moments increased, suggesting more muscle activities were needed to ensure steady and safe progression. The maintenance of dynamic balance on stilts is achieved by incorporating compensatory joint torques into the normal gait pattern so as to minimize the destabilizing forces at elevations. The effect of tool carrying did not show any significance, possibly due to the light weights carried in each hand. The findings of this study provide a better understanding of important aspects related to the biomechanics of gait on stilts. To reduce the potential for loss of balance and overexertion, it is suggested that workers avoid or limit prolonged use of stilts, especially when stilts are elevated at high levels.

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FOOTWEAR EFFECTS ON WORKERS' INSTABILITY IN A VIRTUAL ROOF WORKPLACE.
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Falls from elevation remain the leading cause for fatal injuries in the construction industry, with building roofs as the major source of falls. Previous research has recognized that many of these falls initiate as loss-of-balance incidents. Workers rely heavily on sensory information from their feet to maintain balance in the visually degraded environment at elevation. Shoes act as a sensory interface between the worker's feet and the support surface, and their design can modify balance control. This study evaluated the effect of footwear type/style on workers' instability in a simulated roof workplace.

Twenty-four construction workers performed walking tasks with three athletic and three work shoe styles on 10"- and 6"-wide roof planks. The planks were positioned in a surround-screen virtual reality system which simulated visually the environment on the roof of a residential building. A simulated ground environment served as a baseline. Trunk and foot kinematics and instability perceptions were collected using a balanced experimental design. Dependent variables included the angular velocities of the trunk and the shoe rear end in the frontal plane, and the rated perceived instability.

Repeated measures ANOVA demonstrated significant environment-shoe type interaction effect on all dependent variables. The differences between the shoe types were significant only at the narrow planks at simulated height but not in the baseline conditions. Overall, the shoes with improved motion control characteristics, e.g., tennis and basketball athletic styles, appeared to enhance workers' stability, while the running shoes increased instability. Further, shoes with a higher upper, e.g., work and safety boots style vs. low-cut work shoes, improved

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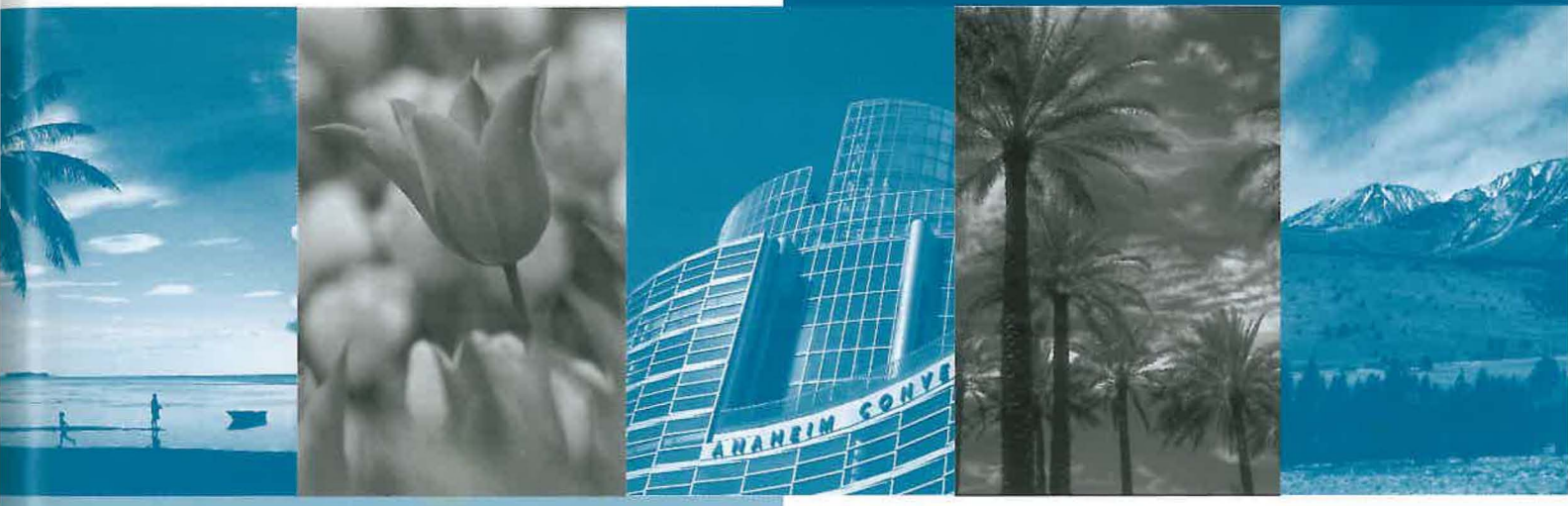

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