

ARBAN - A METHOD FOR ERGONOMIC ANALYSIS OF WORK SITES

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ABSTRACT

A method for analysing ergonomic conditions of work sites is described. The method is based on continuous video-records of work sites, analysed in a laboratory. There, the tape is stopped and the TV-picture is "frozen" at short intervals. The postures of different parts of the worker's body in the stop moment are observed separately. The stress due to the body posture as well as the influence of isometric muscle contraction and external forces are taken into consideration. All factors are then weighed together and the instant stress of every part of the body as well as the total stress is calculated. If there are peak rates of any part or if the total stress of the body exceeds a certain previously stipulated value, the TV screen is pictured. After the analysis of the whole video tape the distribution of the loads is analysed statistically. The results of this analysis show the stress of the different parts of the body during the observed period and its variation with time. The analysis also makes it possible to determine if the loads are mainly caused by rear heavy loads, frequently recurring moderate ones or by a bad working posture. It also allows an estimation of the total ergonomic situation, and comparison with the situations at other work sites. The pictures and the statistical analysis together form a basis for developing work facilities.

An idea how to carry out ergonomic analysis in a rational and systematic way has been followed up and tested within the scope of a pilot study. The aim of the project was to develop a reproducible method for determination of the influence of every single phase of work on the total ergonomic situation of a work site. The results of the analysis will make it possible to classify the situations of different tasks and to rank the relative importance of different moments of work within a task. Thus they form a basis for the development of work facilities.

METHOD

The basic idea of the method is, that through a great number of observations, made within short intervals, a continuously varying ergonomic situation may be described sufficiently. The situation of every single observation can then be analysed separately and the results of all the observations can be compiled with statistical methods.

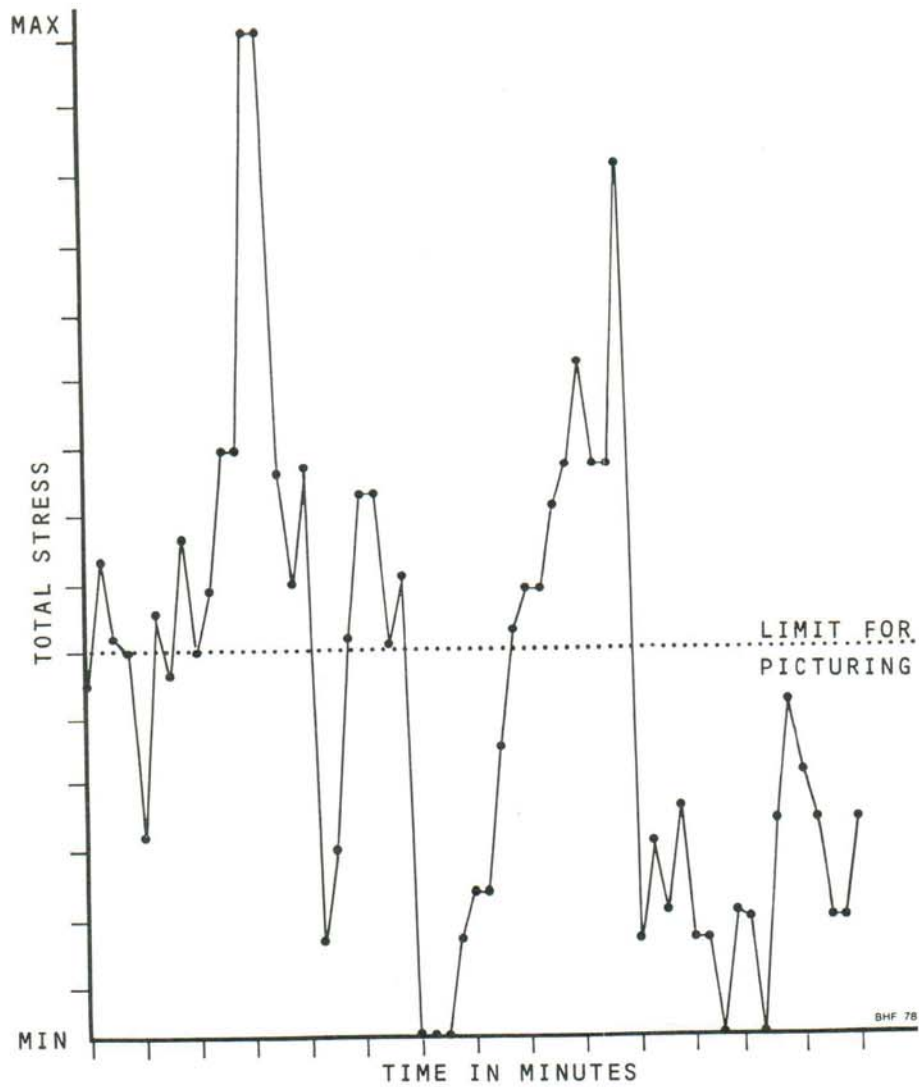


FIG. 1 - Time/stress diagram of a plate worker on a roof. The left peak is caused by an extremely heavy instant stress and the right peak is gradually built up by isometric muscle contraction. Both peaks are followed by "masked" recovery periods. All the observations that lie beyond the dotted line have been pictured.

Practically, this can be done by making continuous video-recordings of a representative period of the studied task. This means that at least one full work cycle should be recorded, including short unplanned pauses, waiting for

materials etc. The tape is then analysed in a laboratory. The tape is stopped in short intervals and the picture on the TV screen is "frozen". The length of the intervals depends on specific factors of the studied task, such as the velocity of the movements and the length of a work cycle.

The instant posture of every part of the body is judged with respect to ergonomic factors. It is also noticed if the posture has been fixed since the previous observation, so that isometric muscle contraction may occur. At the end of an isometric contraction, a phase of recovery is also added. Moreover, the influence of external force is observed. It may be either "passive", such as carrying loads, or "active", such as vibrations, jerks etc.

If any part of the body is exposed to extremely strong forces, if the body takes an unfavourable posture or if the total stress of the body exceeds a certain previously settled limit, the TV screen is pictured. After the analysis of the video tape, the results are compiled by statistical methods.

RESULTS

The analysis of the fluctuations of the stress on different parts of the body as well as on the body as a whole forms, together with the photos, a basis for pointing out extreme work phases. It can be assumed that these contribute significantly to making the work site unfavourable from an ergonomic point of view. The analysis also makes it possible to decide, how a limited ergonomic effort could be most useful (Figure 1). Besides, it enables estimation of the improvement of the overall situation that may be expected from a certain innovation.

DISCUSSION

The method described may be very useful in many situations, where there is a need for ergonomic improvement. It is devised mainly to make it possible to carry out reproducible and comparable ergonomic analysis. The results of the analysis will facilitate an optimum achievement of the resources and form a basis for the development of ergonomic proceedings. By this method it is also possible to compare the ergonomic situations, when the same job is done with different methods or tools.

Finally, the method may be used to teach workers how to adapt their technique of work to their specific physiological conditions.