The 2D Static Strength Prediction Program™

The 2D Static Strength Prediction Program™ (2DSSPP) is a computer software program developed by the Center for Ergonomics at the University of Michigan. The program is designed to assist with the evaluation of heavy manual materials handling tasks that occur in the sagittal plane and in which the effects of acceleration and momentum are negligible. The results of the 2DSSPP can be used to evaluate job task designs or proposed designs before implementation. The program can also be used for instructional purposes and would be especially helpful in teaching the relationship of job task design to the physical demands placed on the worker. The minimum system hardware configuration required for running the program consists of an IBM-PC or compatible computer with 288K RAM, one 360K (5.25") or 720K (3.5") disk drive, and IBM color graphics capability. The program also requires a version of PC-DOS or MS-DOS™ 3.0 or greater. The strength prediction model used in the 2DSSPP program is based on an algorithm described in *Occupational Biomechanics*.[1] The worker strengths used in this prediction model are taken from studies referenced in this same text.

The user enters information regarding the magnitude of the weight being handled, the direction of the force, the number of hands used in the task, height and weight parameters, and limb segment angles. The computer software generates a stick figure illustration of the posture input and hand force generation. The 2DSSPP program also calculates the horizontal distance between the load and the spine, the vertical distance from the floor to the hands, and the horizontal distance between L5/S1 disc and the hands at the origin of the lift. If a given posture and force parameters are likely to cause the worker to fall, then a "balance warning" is generated. The program also estimates the minimal static coefficient of friction required between the worker's feet and the floor surface to prevent slipping.

In addition to generating the stick figure, the 2DSSPP provides data in both tabular and bar chart formats regarding the percent of workers (of similar height and weight) capable of producing the strength necessary to perform the task as defined by the previously entered parameters. These strength predictions are made for each limb segment; any segments that exceed NIOSH-acceptable limits are flagged. Care must be taken when generalizing this information to specific situations and workers. The 2DSSPP program predicts the percent of individuals of a given height and weight who will likely have adequate strength to perform a given task. This prediction does not automatically ensure that a particular individual will be able to perform the task. The individual in question may be stronger or weaker than most others of the same height and weight. However, a job task designed so that 99% of men and 75% of women have the strength to perform the task falls within NIOSH guidelines and is preferable to one which only 70% of men and 50% of women have the strength to perform. The 2DSSPP also provides information regarding the amount of compression that occurs at the disc between L5 and S1 for males and females in both tabular and bar chart format. The back compression predictions are also compared to NIOSH-acceptable limits so that loads exceeding the limit can be easily noted.

In general, the 2DSSPP is very user friendly both for installing and running the program. Grafplus™ software is provided along with the 2DSSPP program to allow printing of the screen images and displays. A user manual with separate sections for each of the programs is provided. The user manual is well written and organized for ease

in use. Directions for installation and use of the program are clearly written. Some further information regarding interpretation and appropriate uses of the information provided by the program would have been helpful, especially for the student or novice user. Otherwise, the manual is thorough and comprehensive. The technical staff is also extremely helpful in ironing out any minor glitches or confusion that may arise. The program runs smoothly and quickly using a hardware system configured as described above.

In summary, the 2DSSPP is an extremely useful and easy to use software program for evaluating work task design for heavy materials handling.

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