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ABSTRACT

The United States Training and Employment Service General Aptitude Test Battery (GATB), first published in 1947, has been included in a continuing program of research to validate the tests against success in many different occupations. The GATB consists of 12 tests which measure nine aptitudes: General Learning Ability; Verbal Aptitude; Numerical Aptitude; Spatial Aptitude; Form Perception; Clerical Perception; Motor Coordination; Finger Dexterity; and Manual Dexterity. The aptitude scores are standard scores with 100 as the average for the general working population, and a standard deviation of 20. Occupational norms are established in terms of minimum qualifying scores for each of the significant aptitude measures which, when combined, predict job performance. Cutting scores are set only for those aptitudes which aid in predicting the performance of the job duties of the experimental sample. The GATB norms described are appropriate for jobs with content similar to that shown in the job description presented in this report. A description of the validation sample is included. (AG)

TECHNICAL REPORT

ON

STANDARDIZATION OF THE GENERAL APTITUDE TEST BATTERY

FOR

BAGGER II 9-68.01
BAG SEALER 9-68.30
PACKER II 9-68.30
WEIGHER II 9-68.01

B-349
or
S-95

U. S. Employment Service in
Cooperation with
California State Employment Service

U. S. DEPARTMENT OF LABOR
Bureau of Employment Security
Washington 25, D. C.
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STANDARDIZATION OF THE GENERAL APTITUDE TEST BATTERY FOR BAGGER II 9-68.01 BAG SEALER 9-68.30 PACKER II 9-68.30 WEIGHER II 9-68.01

B-349 or S-95

Summary

The General Aptitude Test Battery, B-1002A, was administered to a sample of 50 women employed in the jobs of Bagger II 9-68.01, Bag Sealer 9-68.30, Packer II 9-68.30 and Weigher II 9-68.01 by the California Walnut Growers Association, Vernon, California. Forty-seven of the workers were taken off the job and tested on December 8th and 9th of 1955. Three of the workers had been previously tested in a local office and hired without reference to test scores. The criterion consisted of supervisory ratings in rank order based on quantity and quality of the work. On the basis of the statistical results and the job analysis data, Aptitudes F-Finger Dexterity, and M-Manual Dexterity were selected for inclusion in the test norms.

Data were also available for a sample of 33 women employed in the same occupations in Wisconsin. This sample was tested with the GATB, B-1001 and had served as the basis for the development of Aptitude Test Battery B-259. An attempt was made to develop a single set of norms which would show good selective efficiency for the Wisconsin sample as well as for the California sample. This attempt was not successful. For several reasons, the norms resulting from the California study are believed to be more suitable as national norms than the B-259 norms. The new norms, which supersede B-259, have been designated as B-349.

GATB Norms for Bagger II 9-68.01, Bag Sealer 9-68.30, Packer II 9-68.30 and Weigher II 9-68.01 - B-349 or S-95

Table I shows, for B-1001 and B-1002, the minimum acceptable score for each aptitude included in the test norms for B-349 or S-95.

TABLE I

Minimum Acceptable Scores on B-1001 and B-1002 for B-349 or S-95

B-1001			B-1002		
Aptitude	Tests	Minimum Acceptable Aptitude Score	Aptitude	Tests	Minimum Acceptable Aptitude Score
F	CB-1-O CB-1-P	90	F	Part 11 Part 12	85
M	CB-1-M CB-1-N	80	M	Part 9 Part 10	80

Effectiveness of Norms

The data in Table IV indicate that 11 of the 18 poor workers, or 61 percent of them, did not achieve the minimum scores established as cutting scores on the recommended test norms. This shows that 61 percent of the poor workers would not have been hired if the recommended test norms had been used in the selection process. Moreover, 23 of the 30 workers who made qualifying test scores, or 77 percent, were good workers.

TECHNICAL REPORT

I. Problem

This study was conducted to determine the best combination of aptitudes and minimum scores to be used as norms on the General Aptitude Test Battery for the occupations of Bagger II 9-68.01, Bag Sealer 9-68.30, Packer II 9-68.30 and Weigher II 9-68.01.

II. Sample

The GATB, B-1002A, was administered December 8 and 9, 1955, to a sample of 51 women employed as Bagger II 9-68.01, Bag Sealer 9-68.30, Packer II 9-68.30 and Weigher II 9-68.01 at the Vernon, California plant of the California Walnut Growers Association. They were selected from a group of 70 names prepared by the company for workers who had a sixth grade education or the equivalent and who were able to speak, read and write English. Time did not permit the testing of additional workers because of a final layoff which occurred on December 10, 1955. Of the 51 tested workers, two were eliminated from the sample because the forelady was unable to rate them on all phases of the job, one was dropped because of poor vision and one excluded because of language difficulty, leaving 47 in the sample. In addition, three workers who had previously been tested with the GATB in a local Employment Service office and referred without regard to test scores were included in the sample. The final sample, therefore, consisted of 50 women.

Training consists of on-the-job instruction. A maximum of one week is required to train a new worker in the various operations. With the exception of the three workers tested by the local office, the workers in the sample had been with the company for a minimum of 5 seasons.

The preferred age range for hiring new workers is 18 to 45. No experience is required. The ability to speak, read and write English is regarded as the minimum educational requirement. Workers are recruited on a mass hiring basis each season with little time being permitted for extensive interviewing. Older workers are recalled each season and are retained on the basis of seniority when layoffs begin. The sample is composed mainly of the more experienced workers because the testing was done at the close of the season.

Table II shows the means, standard deviations, ranges and Pearson product-moment correlations with the criterion for age, education and experience.

TABLE II

Means (M), Standard Deviations (σ), Ranges, and Pearson Product-Moment Correlations with the Criterion (r) for Age, Education and Experience

Bagger II 9-68.01
Bag Sealer 9-68.30
Packer II 9-68.30
Weigher II 9-68.01

N = 50

	M	σ	Range	r
Age (years)	39.3	8.4	25 - 58	-.239
Education (years)	9.1	2.3	5 - 16	.001
Experience (months)	20.3	5.7	1 - 30	.285*

* Significant at the .05 level

There are no significant correlations between age or education and the criterion. The relationship between experience and the criterion is significant at the .05 level. This may indicate a bias on the part of the supervisor in favor of those workers with the most experience or it may indicate a true relationship -- that is, those workers with the most experience are better able to perform the job. With the exception of three workers who had only one month of experience, all workers in the sample had at least 15 months of experience.

III. Job Descriptions

Job Titles: Bagger II 9-68.01
Bag Sealer 9-68.30
Packer II 9-68.30
Weigher II 9-68.01

Job Summaries

Bagger II: Fills cellophane bags with walnuts: Picks up bag from supply holder with either hand, and positions bag under and onto the filling spout of a semi-automatic filling machine. Starts machine and picks up second bag with other hand. Removes first bag from filling spout when full, sets it upright on conveyor belt, and releases grip at once to prevent moving belt from over-turning bag. Positions next bag onto filling spout, simultaneously returning first hand to pick up next bag. Repeats operation, picking up bag first with one hand and then with the other, filling each bag and placing it on conveyor belt, crossing hands at every other placing operation. At 5 to 10 minute intervals, replenishes empty bag holder from supply box. Stops cycle of operation by pressing control treadle and hits filler chute with closed hand to dislodge nuts when nuts become jammed in chute.

B. Weigher II: Weighs filled cellophane bags of walnuts. Picks up filled bag of walnuts from end of a conveyor belt with one hand and places bag on a scale. Adds to or takes out with either hand the number of nuts indicated on dial of scale. Picks up weighed bag with either hand, sets it upright on an adjacent conveyor belt, and releases grip at once to prevent moving belt from over-turning bag. Repeats operations. Dumps the walnuts from any bag that is split into supply box, and discards bag. Gathers up any walnuts that spill on conveyor belt, when a bag is over-turned, and redeposits them in their bag.

C. Bag Sealer: Seals filled cellophane bags of walnuts. Picks up bag of walnuts from conveyor belt at workers side, using either hand, depending on which side of work table worker is located, and brings bag over to work table. Holds top side edges of bag with both hands, and taps bag on surface of work table to compact the walnuts. Tucks in gussets on both ends with fingers, and closes bag. Holds top outside edges of bag with both hands, inserts leading edge of bag into automatic Sealing Machine. Discards bags of nuts that have been split or obviously improperly weighed down chute of work table.

NOTE: Sealers work in pairs facing each other across a work table which has a discard chute at one end, and a sealing machine at the other. Workers must co-ordinate their cycle of operation so that the bags are inserted in the sealing machine on an alternating basis.

D. Packer II: Packs cellophane bags of walnuts into prefolded cardboard cartons: Lifts carton from overhead roller rack above work space, and adjusts carton in a tilted carton holder behind conveyor belt. Picks up from conveyor belt, two or three bags of walnuts at a time, using both hands. Bends over and positions bags in sections of carton with sealed ends up. Continues process until bottom layer contains 25 bags. Secures a layer divider and anaassembled section divider from a supply under conveyor belt, and positions them in carton. Repeats process to fill top layer with 25 bags. Pushes top side of filled carton, causing carton holder to tilt back, dropping carton onto a conveyor belt. Repeats operation, inspecting bags for improper seals and material failures while packing.

IV. Experimental Battery

All of the parts of the GATB, B-1002A, were administered to the sample group.

V. Criterion

The criterion consists of supervisory ratings in rank order prepared by the head forelady. No other measures of job performance were available and no other persons were sufficiently familiar with the workers in the sample to evaluate their performance. The head forelady had supervised all but three of the workers in the sample for five or more seasons. Two sets of ratings were prepared approximately three weeks apart. The ratings were prepared by first grouping the workers according to the "best third" and the "lowest third." The remaining workers formed the "middle third." Ranks were then

assigned within the groupings. The same procedure was followed for the second rating. The two sets of rank order ratings were converted to linear scores and averaged to produce the final criterion. A reliability coefficient (Pearson product-moment correlation) of .708 was obtained between the first and second ratings of the forelady, which was corrected by the Spearman-Brown Prophecy formula to .829 for the average to the two sets of ratings.

VI. Statistical and Qualitative Analysis

Table III shows the means, standard deviations and Pearson product-moment correlations with the criterion for the aptitudes of the GATB. The means and standard deviations of the aptitudes are comparable to general working population norms with a mean of 100 and a standard deviation of 20.

TABLE III

Means (M), Standard Deviations (σ), and Pearson Product-Moment Correlations with the Criterion (r) for the Aptitudes of the GATB

Bagger II 9-68.01
Bag Sealer 9-68.30
Packer II 9-68.30
Weigher II 9-68.01

N = 50

Aptitudes	M	σ	r
G-Intelligence	78.9	14.9	.103
V-Verbal Aptitude	87.3	15.1	.018
N-Numerical Aptitude	72.9	16.8	-.022
S-Spatial Aptitude	80.7	17.3	.274
P-Form Perception	78.3	18.6	.245
Q-Clerical Aerception	82.6	12.6	.100
K-Motor Coordination	97.8	16.0	.322*
F-Finger Dexterity	92.2	15.9	.317*
M-Manual Dexterity	91.8	15.0	.376**

** Significant at the .01 level
* Significant at the .05 level

The statistical results were interpreted in the light of the job analysis data. The job analysis indicated that the following aptitudes measured by the GATB appear to be important for this occupation:

K-Motor Coordination - required in the shifting, guiding and crossing of hands in the filling operation, where it is necessary to coordinate the hand movements to keep pace with the filling machine; also required in handling filled cellophane bags in the weighing, sealing and packing operations.

F-Finger Dexterity - required to grasp the cellophane bags from their supply holders during the filling operation and to tuck in gussets of bags in the sealing operation.

M-Manual Dexterity - required in the handling of filled bags at all work stations, in the adding or taking away of nuts at the weighing operation and in the handling of cardboard cartons and packing filled bags into cartons.

The highest mean scores were obtained in descending order of magnitude for Aptitudes K, F and M, respectively. All of the aptitudes have standard deviations less than 20, with Aptitude Q exhibiting the smallest standard deviation.

When N = 50, correlations of .361 and .279 are significant at the .01 level and the .05 level of confidence, respectively. Aptitude M correlates significantly with the criterion at the .01 level and Aptitudes K and F correlate significantly with the criterion at the .05 level of confidence.

Aptitudes K, F and M were considered for inclusion in the test norms on the basis of the qualitative and quantitative factors cited above. All of these aptitudes appeared to be important in terms of the job analysis data, showed relatively high mean scores and significant correlations with the criterion. Tetrachoric correlations with the criterion were computed for several sets of trial norms consisting of various combinations of Aptitudes K, F and M and appropriate cutting scores. However, the addition of Aptitude K tended to lower the selective efficiency of norms which included Aptitudes F and M. Therefore, Aptitude K was excluded from the final test norms which included Aptitudes F and M. The cutting score for Aptitude F was set at one half standard deviation below the mean score and rounded to the nearest five-point score level. For Aptitude M, the cutting score was set at one standard deviation below the mean score and rounded to the higher adjacent five-point score level. Setting cutting scores at these levels yielded the best selective efficiency for the norms and resulted in critical scores of 85 and 80 for Aptitudes F and M, respectively.

VII. Concurrent Validity of Norms

The criterion was dichotomized for the purpose of computing the tetrachoric correlation coefficient between the test norms and the criterion and applying the Chi Square test. The head forelady and plant superintendent indicated that the point of demarcation between acceptable and marginal workers fell between the workers assigned ranks 32 and 33. Therefore, rank 32 was set as the criterion critical score so that the 18 workers with the lowest ranks, or 36 percent of the sample, were placed in the low criterion group.

Table IV shows the relationship between the dichotomized criterion and test norms consisting of Aptitudes F and M with critical scores of 85 and 80, respectively, and the criterion for Bagger II 9-68.01, Bag Sealer 9-68.30, Packer II 9-68.30 and Weigher II 9-68.01. Workers in the high criterion group have been designated as "good workers" and those in the low criterion group as "poor workers."

TABLE IV

Relationship between Test Norms Consisting of Aptitudes F and M with Critical Scores of 85 and 80, Respectively, and the Criterion for Bagger II 9-68.01, Bag Sealer 9-68.30, Packer II 9-68.30 and Weigher II 9-68.01

N = 50

	Non-Qualifying Test Scores	Qualifying Test Scores	Total
Good Workers	9	23	32
Poor Workers	11	7	18
Total	20	30	50

$r_{tet} = .50$ $\quad X^2 = 3.939$

$\sigma_{r_{tet}} = .23$ $\quad P/2 < .025$

The data in the above table indicate a significant relationship between the test norms and the criterion for this sample.

Data were also available for a sample of 33 employed workers in the following occupations: Bagger II 9-68.01; Bag Sealer 9-68.30; Box Sealer II 9-68.30; Filling-Machine Tender I 9-68.01; Laborer, Filling 9-68.01; Laborer, Packing 9-68.30; Packer II 9-68.30; Weigher II 9-68.01; and Wire-Stitcher Operator 9-68.30. This sample was tested with the B-1001 edition of the GATB between November 1951 and May 1952. The data obtained for this sample served as the basis for the development of B-1001 norms consisting of A-80, T-80, F-85 and M-85 (equivalent B-1002 norms consist of K-85, F-80 and M-80) which were established as B-259. Since the 1952 study included the same occupations as the 1956 study and the duties of the two sets of occupations were sufficiently similar to warrant use of a common set of aptitude test norms, an attempt was made to establish one set of norms which would show good selective efficiency for the B-259 study sample as well as for the sample used in the present study. This attempt was not successful--no one set of norms tried yielded significant tetrachoric correlation coefficients for each of the two samples. For the following reasons it was decided to supersede the B-259 norms with norms established on the basis of the present study:

1. The sample for the present study (N = 50) is larger than the study which resulted in the B-259 norms (N = 33) and, therefore, is likely to yield more stable results.

2. The criterion of the B-259 sample was dichotomized with a relatively small proportion in the low criterion group, which tends to reduce the stability of the obtained tetrachoric correlation coefficient.

3. The data of the present study is based on the B-1002 edition of the GATB, whereas the data of the B-259 study is based on the B-1001 edition of the GATB.

VIII. Conclusions

On the basis of mean scores, correlations with the criterion, job analysis data and their combined selective efficiency, Aptitudes F and M with minimum scores of 85 and 80, respectively, are recommended as B-1002 norms for the occupations of Bagger II 9-68.01, Bag Sealer 9-68.30, Packer II 9-68.30 and Weigher II 9-68.01. The equivalent B-1001 norms consist of F-90 and M-80.

IX. Determination of Occupational Aptitude Pattern

When the specific test norms for an occupation include two aptitudes, only those occupational aptitude patterns which include the same two aptitudes with cutting scores that are within 10 points of the cutting scores established for the specific norms are considered for that occupation. Four of the existing 22 occupational aptitude patterns meet these criteria for this study. These occupational aptitude patterns and their B-1002 norms are OAP-10, G-75, F-75, M-80; OAP-14, S-80, F-90, M-85; OAP-16, P-75, F-80, M-80; and OAP-17, K-85, F-80, M-80. The selective efficiency of each of these OAP's for this sample was determined by means of the tetrachoric correlation technique. No significant relationship was obtained between any of the four OAP's and the dichotomized criterion. Therefore, none of the existing 22 occupational aptitude patterns is recommended for the occupations of Bagger II 9-68.01, Bag Sealer 9-68.30, Packer II 9-68.30 and Weigher II 9-68.01. However, the data for this sample will be considered for future groupings of occupations in the development of new occupational aptitude patterns.