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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 only 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)

FINAL REPORT

TECHNICAL REPORT

ON

STANDARDIZATION OF THE GENERAL APTITUDE TEST BATTERY

FOR

Assembler, Automobile . 806.887

S-101

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

U. S. DEPARTMENT OF LABOR

Washington, D. C.
April 1957

GATB #2125
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STANDARDIZATION OF THE GENERAL APTITUDE TEST BATTERY
FOR
Assembler, Automobile 806.887

S-161

Summary

The General Aptitude Test Battery, B-1002A, was administered to a sample of 72 men employed as Assembler, Automobile [illegible] by Chevrolet-Oakland, Oakland, California. The criterion consisted of broad category ratings provided by four supervisors. On the basis of mean scores, correlations with the criterion, job analysis data and their combined selective efficiency, Aptitudes P-Form Perception, F-Finger Dexterity and M-Manual Dexterity were selected for inclusion in the test norms.

GATB Norms for Assembler, Automobile 806.887

Table I shows, for B-1001 and B-1002, the minimum acceptable score for each aptitude included in the test norms for Assembler, Automobile 806.887.

TABLE I

Minimum Acceptable Scores on B-1001 and B-1002 for S-161

B-1001			B-1002		
Aptitude	Tests	Minimum Acceptable Aptitude Score	Aptitude	Tests	Minimum Acceptable Aptitude Score
P	CB-1-A CB-1-L	80	P	Part 5 Part 7	80
F	CB-1-O CB-1-P	85	F	Part 11 Part 12	80
M	CB-1-M CB-1-N	80	M	Part 9 Part 10	80

Effectiveness of Norms

The data in Table IV indicate that 13 of the 24 poor workers, or 54 percent of them, did not achieve the minimum scores established as cutting scores on the recommended test norms. This shows that 54 percent of the poor workers would not have been hired if the recommended test norms had been used in the selection process. Moreover, 37 of the 48 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 occupation of Assembler, Automobile 806.887.

II. Sample

The GATB, B-1002A, was administered between February 14 and March 8, 1956 to 81 men employed as General Assemblers at Chevrolet-Oakland, Oakland, California. This plant is the assembly plant for passenger cars. All testing was done on a voluntary basis. Because of the size of the total assembly group (250 - 300), it seemed best to approximate a random sample as closely as possible. Each of four foremen supervised a specified portion of the total group. In order to obtain a representative sample and avoid loss of production in any one foreman's group, the number of workers required from a group was determined by that group's percentage of the total number of General Assemblers in the plant. The size of the sample plant management could release for the testing time was first set at 75 and then at 81 to insure an adequate final sample. Name cards were prepared for all assemblers and the specified number of names was drawn for each group separately. Names were then checked with personnel records for age, education and experience data to be sure that those included in the sample would meet the requirements of the project. Those who did not wish to take the test were excused and another worker's name was drawn to replace them. Nine of the 81 workers were excluded from the final sample because they were unable to perform on one or more of the tests. Therefore, the final sample includes 72 men.

The foremen estimated that it took from four days to two weeks of on-the-job training to learn to do the job adequately with normal supervision. Applicants 18 years of age and over are hired for this job. The job requires physical effort and agility beyond that usually possessed by older men and the company is reluctant to accept applicants over 45 years of age. The education requirements are the ability to speak, read and write English. Written applications are required and all applicants are given an employment interview. In addition, there is a thorough routine pre-employment physical examination by company doctors. Workers serve a six-month probationary period and are then considered permanent employees with seniority rights.

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

TABLE II

Means (M), Standard Deviations (σ), Ranges, and Pearson Product-Moment Correlations (Corrected for Broad Categories) with the Criterion ($_cr$) for Age, Education, and Experience

Assembler, Automobile 806.887
N = 72

	M	σ	Range	$_cr$
Age (years)	29.4	6.5	19-45	-.534**
Education (years)	10.6	2.0	6-16	-.169
Experience (months)	28.5	33.9	1-204	-.264*

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

The data in the above table indicate that both age and experience show negative correlations with the criterion which are significant at the .01 and .05 levels, respectively. This does not seem unusual in view of the fact that this job is known to require more physical strength and agility than most older men possess. A correlation significant at the .01 level (.44) was obtained between age and experience, which is consistent with the fact that both age and experience show significant negative correlation with the criterion. There is no significant correlation between education and the criterion. The data in Table II indicate that this sample is suitable for test development purposes with respect to age, education and experience.

III. Job Description

Job Title: Assembler, Automobile 806.887

Job Summary: Performs any of the following operations in the final assembly of an automobile, using mechanic's hand tools and special hand tools, such as pneumatic wrenches and screw-drivers. Works on the trim-line, and installs or attaches units and subassemblies, such as instrument cluster (speedometer, ammeter, fuel and oil gages), control-button assemblies, heater, brake-and-clutch pedal assemblies, and tail-light assemblies to bodies; fits units or assemblies into position by hand and fastens them in place with bolts or screws, and connects electrical wiring. Fastens component parts together at workbench to complete units or assemblies. Works on motor frame or final-assembly lines, and attaches or installs such units as carburetor, distributor, transmission, and exhaust, or springs, brakes, and shock absorbers, fitting units into place by hand, with the aid of another worker. Connects cables, wires, and harnesses. Works at workbench, and bolts, screws, or otherwise attaches component parts together to form a unit or assembly. Works alongside or in pit beneath frames (chassis), on moving conveyor before or after bodies are dropped (lowered) onto frames.

IV. Experimental Battery

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

V. Criterion

The criterion consisted of supervisory ratings in broad categories, prepared by four foremen. The ratings were based on a combination of speed, accuracy and adaptability of the worker when transferred to another station. The foremen rated each of their own men in comparison with assemblers in all four groups. Each foreman had a working knowledge of the other groups and also had actual lead or foreman experience in more than one group. The foremen agreed that the four supervisional sections of the assembly operation were comparable. The workers were able to work interchangeably in all of those groups. The ratings of each of the four foremen were combined by grouping together all of the workers rated "best," "average" and "poorest" in their respective categories. This resulted in 24 people in each of the three groups. For computational purposes, the ratings were converted to quantitative values of 61, 50 and 39 for the best, average and poorest groups, respectively.

Prior to the development of the broad category ratings, a rank order rating was attempted. Each of the foremen rated those men under him and the general foreman prepared independent ratings on all of the men. However, the foremen found that it was almost impossible to rate each man separately and the general foreman discovered he did not know the work of the individuals well enough to make valid comparisons. In addition, it was discovered that several of the men had been rated mistakenly by the wrong foreman. Therefore, only the broad category ratings were used as a criterion.

VI. Statistical and Qualitative Analysis

Table III shows the means, standard deviations, and Pearson product-moment correlations (corrected for broad categories) 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 (Corrected for Broad Categories) with the Criterion ($_{c}r$) for the Aptitudes of the GATB

Assembler, Automobile 806.887
N = 72

Aptitudes	M	σ	$_{c}r$
G-Intelligence	90.9	13.5	.087
V-Verbal Aptitude	90.0	14.9	-.057
N-Numerical Aptitude	86.8	14.7	.037
S-Spatial Aptitude	95.7	17.4	.187
P-Form Perception	94.3	16.6	.306**
Q-Clerical Perception	93.7	13.2	.229
K-Motor Coordination	91.6	17.8	.106
F-Finger Dexterity	98.0	16.9	.291*
M-Manual Dexterity	95.8	15.3	.310**

** 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:

Form Perception (P) - required to perceive fit of parts and to detect defective or improperly threaded or sized bolts, nuts and screws.

Finger Dexterity (F) - required to pick single bolts, nuts and screws rapidly from the supply box and position them accurately, and to fit parts together.

Manual Dexterity (M) - required to use hand tools and position parts accurately.

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

When N = 72, correlations of .302 and .232 are significant at the .01 level and the .05 level of confidence, respectively. Aptitudes P and M correlate significantly with the oriterion at the .01 level. Aptitude F correlates significantly with the criterion at the .05 level.

Aptitudes P, F and M were considered for inclusion in the test norms on the basis of the quantitative and qualitative factors cited above. All of these aptitudes appear to be important in terms of the job analysis data; in addition, Aptitudes P, F and M have 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 P, F and M and appropriate cutting scores. The results obtained indicated that all three of those aptitudes should be included in the test norms. Cutting scores were set at five-point score levels closest to one standard deviation below the mean scores. Setting cutting scores at these levels yielded good selective efficiency for the norms and resulted in a critical score of 80 for Aptitudes P, F and M. Although norms consisting of P-75, F-80 and M-80 yielded a slightly higher tetrachoric correlation coefficient than norms consisting of P-80, F-80 and M-80, the latter norms screened out one additional person in the low criterion group and failed a proportion of the total sample that is equal to the proportion (one-third) in the low criterion group. Therefore, P-80, F-80 and M-80 were selected as norms for Assembler, Automobile 806.887.

VII. Concurrent Validity of Norms

For the purpose of computing the tetrachoric correlation coefficient between the test norms and the criterion and applying the Chi Square test, the criterion was dichotomized by placing those workers who were rated "best" and "average" into the high criterion group and those workers who were rated "poor" into the low criterion group. This placed 24 of the 72 workers, or 33 percent of them, into the low criterion group.

Table IV shows the relationship between test norms consisting of Aptitudes P, F and M, each with a critical score of 80, and the dichotomized criterion. 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 P, F and M each with a Critical Score of 80 and the Criterion for Assembler, Automobile 806.887

N = 72

	Non-Qualifying Test Scores	Qualifying Test Scores	Total
Good Workers	11	37	48
Poor Workers	13	11	24
Total	24	48	72

$r_{tet} = .50$ $\quad X^2 = 5.695$

$\sigma_{r_{tet}} = .20$ $\quad P/2 \quad .01$

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

VIII. Conclusions

On the basis of mean scores, correlations with the criterion, job analysis data and their combined selective efficiency, Aptitudes P, F and M each with a minimum score of 80, are recommended as B-1002 norms for the occupations of Assembler, Automobile The equivalent B-1001 norms consist of P-80, F-85 and M-80.

IX. Determination of Occupational Aptitude Pattern

When the specific test norms for an occupation include three aptitudes, only those occupational aptitude patterns which include the same three aptitudes with cutting scores that are within 10 points of the cutting scores established for the specific norms are considered for that occupation. The only one of the existing 22 occupational aptitude patterns which meets these criteria for this study is OAP-16, which consists of P-75, F-80 and M-80 for B-1002. The selective efficiency of OAP-16 for this sample was determined by means of the tetrachoric correlation technique. A tetrachoric correlation of .56 with a standard error of .21 was obtained, which indicates a significant relationship between OAP-16 and the criterion for this experimental sample. The proportion of the sample screened out by OAP-16 was .28, which is within the required range of .10 to .60. Therefore, it is recommended that OAP-16 be used in counseling for the occupation of Assembler, Automobile 806.887.