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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 and a personnel evaluation form are also included. (AG)

February 1968 United States Employment Service Technical Report S-408

S-408

Development of USES Aptitude Test Battery for Cable Assembler

(wirework) 709.884

U.S. DEPARTMENT OF LABOR
MANPOWER ADMINISTRATION

Technical Report on Development of USES Aptitude Test Battery

For . . . .

Cable Assembler (wirework) 709.884

S-408

(Developed in Cooperation with the
Pennsylvania State Employment Service)

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February 1968

FOREWORD

The United States Employment Service General Aptitude Test Battery (GATB) was first published in 1947. Since that time the GATB has been included in a continuing program of research to validate the tests against success in many different occupations. Because of its extensive research base the GATB has come to be recognized as the best validated multiple aptitude test battery in existence for use in vocational guidance.

The GATB consists of 12 tests which measure 9 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, with a standard deviation of 20.

Occupational norms are established in terms of minimum qualifying scores for each of the significant aptitude measures which, in combination, predict job performance. For any given occupation, cutting scores are set only for those aptitudes which contribute to the prediction of performance of the job duties of the experimental sample. It is important to recognize that another job might have the same job title but the job content might not be similar. The GATB norms described in this report are appropriate for use only for jobs with content similar to that shown in the job description included in this report.

Charles E. Odell, Director
U.S. Employment Service

GATB Study #2690

DEVELOPMENT OF USES APTITUDE TEST BATTERY

for

CABLE ASSEMBLER (wirework) 709.884-024

S-408

This report describes research undertaken for the purpose of developing General Aptitude Test Battery (GATB) norms for the occupation of Cable Assembler (wirework) 709.884-024. The following norms were established:

GATB Aptitudes	Minimum Acceptable GATB Scores
G - General Learning Ability	75
Q - Clerical Perception	95
F - Finger Dexterity	85

RESEARCH SUMMARY

Sample

53 female workers employed as Cable Assemblers at the Pennsylvania Wire Rope Corporation in Williamsport, Pennsylvania.

Criterion

Supervisory ratings

Design

Concurrent (test and criterion data were collected at approximately the same time.)

Minimum aptitude requirements were determined on the basis of a job analysis and statistical analyses of aptitude mean scores, standard deviations, aptitude-criterion correlations, and selective efficiencies.

Concurrent Validity

Phi Coefficient = .50 (P/2 less than .0005)

Effectiveness of Norms

Only 64% of the nontest-selected workers used for this study were good workers; if the workers had been test-selected with the S-408 norms, 87% would have been good workers. 36% of the nontest-selected workers used for this study were poor workers; if the workers had been test-selected with the S-408 norms only 13% would have been poor workers. The effectiveness of the norms is shown graphically in Table 1:

TABLE 1

Effectiveness of Norms

	Without Norms	With Norms
Good Workers	64%	87%
Poor Workers	36%	13%

SAMPLE DESCRIPTION

Size

N = 53

Occupational Status

Employed workers

Work Setting

Workers were employed at the Pennsylvania Wire Rope Corporation, Williamsport, Pennsylvania

Employer Selection Requirements

Education: No required amount of formal education although the applicants must have a minimal ability to read, speak and write English.

Previous Experience: None

Tests: None

Other: Interview

Principal Activities

The job duties for each worker are comparable to those shown in the job description in the Appendix.

Minimum Experience

All workers in the sample had at least one month total job experience.

TABLE 2

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

	Mean	SD	Range	r
Age (years)	34.4	9.6	19 - 54	.188
Education (years)	10.3	1.5	7 - 13	.059
Experience (months)	27.2	33.4	1 - 120	.334

EXPERIMENTAL TEST BATTERY

All 12 tests of the GATB, B-1002B, were administered during the latter half of October 1967.

CRITERION

The criterion consisted of supervisory ratings of job proficiency made at approximately the same time as test data were collected. Ratings and re-ratings were made by the shift leader of each worker with a two-week interval between ratings.

Rating Scale

USES Form SP-21 "Descriptive Rating Scale." (See Appendix) This scale consists of nine items covering different aspects of job performance. Each item has five alternatives corresponding to different degrees of job proficiency.

Reliability

The reliability coefficient between the two ratings is .92, indicating a significant relationship. Therefore, the final criterion consisted of the combined scores of the two sets of ratings.

Criterion Score Distribution

Possible Range:	18 - 90
Actual Range:	30 - 90
Mean:	58.62
Standard Deviation:	13.14

Criterion Dichotomy

The criterion distribution was dichotomized into high and low groups by placing 36% of the sample in the low group to correspond with the percentage of workers considered unsatisfactory or marginal. Workers in the high criterion group were designated as "good workers" and those in the low group as "poor workers." The criterion critical score is 56.

APTITUDES CONSIDERED FOR INCLUSION IN THE NORMS

Aptitudes were selected for tryout in the norms on the basis of a qualitative analysis of the job duties involved and statistical analysis of test and criterion data. Aptitude M which does not have a significant correlation with the criterion was considered for inclusion in the trial norms because qualitative analysis indicated that this aptitude was important for the job duties and the sample had a relatively high mean score and a low standard deviation on this aptitude. Tables 3, 4 and 5 show the results of the qualitative and quantitative analyses.

TABLE 3

Qualitative Analysis
(Based on the job analysis the following aptitudes appear to be important to the work performed)

P - Form Perception	To read gauges, to visually inspect cables, to align fittings with cable ends, to determine stretch of small cables.
K - Motor Coordination	To aim cable into conduit by hand, threading two at a time while holding both side by side; to use foot pedal for pressing clamp on end of cable.
F - Finger Dexterity	To twist ends of strands together in order to facilitate threading, to handle small metal hooks, pins and lengths of wire.
M - Manual Dexterity	To handle cables singly or in bundles, to hold cables with fittings under presses, to destroy defective cables.

TABLE 4

Means, Standard Deviations (SD), Ranges, and Pearson Product-Moment Correlations with the Criterion (r) for the Aptitudes of the GATB; N = 53

Aptitudes	Mean	SD	Range	r
G - General Learning Ability	83.38	15.89	56 - 121	.485**
V - Verbal Aptitude	88.62	12.25	66 - 125	.564**
N - Numerical Aptitude	84.24	20.15	36 - 122	.393**
S - Spatial Aptitude	87.49	17.66	55 - 127	.224
P - Form Perception	100.36	20.48	46 - 137	.216
Q - Clerical Perception	105.96	13.70	78 - 131	.385**
K - Motor Coordination	99.75	21.45	49 - 153	.391**
F - Finger Dexterity	108.85	19.45	71 - 144	.350*
M - Manual Dexterity	106.21	23.44	40 - 149	.266

*Significant to the .05 level
**Significant to the .01 level

TABLE 5
Summary of Qualitative and Quantitative Data

Type of Evidence	Aptitudes								
	G	V	N	S	P	Q	K	F	M
Job Analysis Data									
Important					X		X	X	X
Irrelevant		O	O						
Relatively High Mean						X		X	X
Relatively Low Standard Dev.		X				X			
Significant Correlation with Criterion	X	X	X			X	X	X	
Aptitudes to be Considered for Trial Norms	G					Q	K	F	M

DERIVATION AND VALIDITY OF NORMS

Final norms were derived on the basis of a comparison of the degree to which trial norms consisting of various combinations of aptitudes G, Q, K, F and M at trial cutting scores were able to differentiate between the 64% of the sample considered good workers and the 36% of the sample considered poor workers. Trial cutting scores at five-point intervals approximately one standard deviation below the mean are tried because this will eliminate about one-third of the sample with three aptitude norms. For two aptitude trial norms, minimum cutting scores slightly higher than one standard deviation below the mean will eliminate about one-third of the sample; for four-aptitude trial norms, cutting scores slightly lower than one standard deviation below the mean will eliminate about one-third of the sample. The Phi Coefficient was used as a basis for comparing trial norms. The optimum differention for the occupation of Cable Assembler (wirework) 709.884-024 was provided by the norms of G-75, Q-95 and F-85. The validity of these norms is shown in Table 6 and is indicated by a Phi Coefficient of .50 (statistically significant at the .0005 level).

TABLE 6

Concurrent Validity of Test Norms, G-75, Q-95, F-85

	Nonqualifying Test Scores	Qualifying Test Scores	Total
Good Workers	8	26	34
Poor Workers	15	4	19
Total	23	30	53

Phi Coefficient = .50
Chi Square (X^2_y) = 13.07
Significance Level = P/2 less than .0005

DETERMINATION OF OCCUPATIONAL APTITUDE PATTERN

The data for this study did not meet the requirements for incorporating the occupation studied into any of the 36 OAP's included in Section II of the Manual for the General Aptitude Test Battery. The data for this sample will be considered for future groupings in the development of new occupational aptitude patterns.

SP-21
Rev. 2/61

A-P-P-E-N-D-I-X

DESCRIPTIVE RATING SCALE
(For Aptitude Test Development Studies)

Score____

RATING SCALE FOR _____
D. O. T. Title and Code

Directions: Please read Form SP-20, "Suggestions to Raters", and then fill in the items listed below. In making your ratings, only one box should be checked for each question.

Name of Worker (print) _____
(Last) (First)

Sex: Male____ Female____

Company Job Title: _____

How often do you see this worker in a work situation?

☐ See him at work all the time.

☐ See him at work several times a day.

☐ See him at work several times a week.

☐ Seldom see him in work situation.

How long have you worked with him?

☐ Under one month.

☐ One to two months.

☐ Three to five months.

☐ Six months or more.

A. How much work can he get done? (Worker's ability to make efficient use of his time and to work at high speed.)

- ☐ 1. Capable of very low work output. Can perform only at an unsatisfactory pace.
- ☐ 2. Capable of low work output. Can perform at a slow pace.
- ☐ 3. Capable of fair work output. Can perform at an acceptable but not a fast pace.
- ☐ 4. Capable of high work output. Can perform at a fast pace.
- ☐ 5. Capable of very high work output. Can perform at an unusually fast pace.

B. How good is the quality of his work? (Worker's ability to do high-grade work which meets quality standards.)

- ☐ 1. Very poor. Does work of unsatisfactory grade. Performance is inferior and almost never meets minimum quality standards.
- ☐ 2. Not too bad, but the grade of his work could stand improvement. Performance is usually acceptable but somewhat inferior in quality.
- ☐ 3. Fair. The grade of his work is mediocre. Performance is acceptable but usually not superior in quality.
- ☐ 4. Good, but the grade of his work is not outstanding. Performance is usually superior in quality.
- ☐ 5. Very good. Does work of outstanding grade. Performance is almost always of the highest quality.

C. How accurate is he in his work? (Worker's ability to avoid making mistakes.)

- ☐ 1. Very inaccurate. Makes very many mistakes. Work needs constant checking.
- ☐ 2. Inaccurate. Makes frequent mistakes. Work needs more checking than is desirable.
- ☐ 3. Fairly accurate. Makes mistakes occasionally. Work needs only normal checking.
- ☐ 4. Accurate. Makes few mistakes. Work seldom needs checking.
- ☐ 5. Highly accurate. Rarely makes a mistake. Work almost never needs checking.

D. How much does he know about his job? (Worker's understanding of the principles, equipment, materials and methods that have to do directly or indirectly with his work.)

- ☐ 1. Has very limited knowledge. Does not know enough to do his job adequately.
- ☐ 2. Has little knowledge. Knows enough to "get by."
- ☐ 3. Has moderate amount of knowledge. Knows enough to do fair work.
- ☐ 4. Has broad knowledge. Knows enough to do good work.
- ☐ 5. Has complete knowledge. Knows his job thoroughly.

E. How much aptitude or facility does he have for this kind of work? (Worker's adeptness or knack for performing his job easily and well.)

- ☐ 1. Very low aptitude. Has great difficulty doing his job. Not at all suited to this kind of work.
- ☐ 2. Low aptitude. Usually has some difficulty doing his job. Not too well suited to this kind of work.
- ☐ 3. Moderate aptitude. Does his job without too much difficulty. Fairly well suited to this kind of work.
- ☐ 4. High aptitude. Usually does his job without difficulty. Well suited to this kind of work.
- ☐ 5. Very high aptitude. Does his job with great ease. Unusually well suited for this kind of work.

F. How large a variety of job duties can he perform efficiently? (Worker's ability to handle several different operations in his work.)

- ☐ 1. A very limited variety. Cannot perform different operations adequately.
- ☐ 2. A small variety. Can perform few different operations efficiently.
- ☐ 3. A moderate variety. Can perform some different operations with reasonable efficiency.
- ☐ 4. A large variety. Can perform several different operations efficiently.
- ☐ 5. An unusually large variety. Can do very many different operations efficiently.

G. How resourceful is he when something different comes up or something out of the ordinary occurs? (Worker's ability to apply what he already knows to a new situation.)

☐ 1. Almost never is able to figure out what to do. Needs help on even minor problems.

☐ 2. Often has difficulty handling new situations. Needs help on all but simple problems.

☐ 3. Sometimes knows what to do, sometimes doesn't. Can deal with problems that are not too complex.

☐ 4. Usually able to handle new situations. Needs help on only complex problems.

☐ 5. Practically always figures out what to do himself. Rarely needs help, even on complex problems.

H. How many practical suggestions does he make for doing things in better ways? (Worker's ability to improve work methods.)

☐ 1. Sticks strictly with the routine. Contributes nothing in the way of practical suggestions.

☐ 2. Slow to see new ways to improve methods. Contributes few practical suggestions.

☐ 3. Neither quick nor slow to see new ways to improve methods. Contributes some practical suggestions.

☐ 4. Quick to see new ways to improve methods. Contributes more than his share of practical suggestions.

☐ 5. Extremely alert to see new ways to improve methods. Contributes an unusually large number of practical suggestions.

I. Considering all the factors already rated, and only these factors, how acceptable is his work? (Worker's "all-around" ability to do his job.)

☐ 1. Would be better off without him. Performance usually not acceptable.

☐ 2. Of limited value to the organization. Performance somewhat inferior.

☐ 3. A fairly proficient worker. Performance generally acceptable.

☐ 4. A valuable worker. Performance usually superior.

☐ 5. An unusually competent worker. Performance almost always top notch.

FACT SHEET

Job Title

Cable Assembler (wirework) 709.884-024

Job Summary

Assembles control cables by cutting wire rope to length, inserting in conduit, attaching fittings, staking fittings in place, swaging terminals to size cutting off excess cable, and testing cables for length and strength.

Work Performed

1. Cuts cable: Cuts wire rope to specified lengths by operating automatic electric cutting machine. Threads machine by entering wire rope in guides, around wheels, and between electrodes. Adjusts autotransformer by turning handwheel to secure enough heat to melt off wire rope without either a lumpy end or unraveling. Presses button to start machine and observes and listens to its operation. Stoops and lifts a bundle of cables from eject hopper of cutter, pulls them along floor to a convenient position. Kneels and slips a screw over one end of each to make sure they are not oversize. Hand files off any excess diameter. Lifts cables to bench, checks diameter of terminal ends by sliding a terminal over each, files off excess, counts cables and ties in bundles of 50 or 100. Marks terminal ends with yellow crayon. Drops defective cables in scrap barrel. Oils bearings with oil can. Cuts small cable by pulling end of cable from spool, entering it in hole of cutting tool on press and pushing it through; pushes end against stop and presses pedal to cause air-actuated press to cut desired length. Lays cable on bench or throws it on reject pile if it is too short or is bent. Counts cables and ties in bundles with wire-reinforced paper tie.

2. Stakes fittings on cable or conduit: Caps first ends of conduit by picking up end of conduit and pushing it into cap held in other hand. Inserts capped end in fixture on presses and depresses pedal to close press. Throws capped cables into bin and keeps count of cables capped. Stakes fittings on ends of small cables. Picks up one clamp from bench with tweezers and places it open side up in fixture of air-actuated press. Pulls end of cable from cutting press, winds end of cable around pin of fixture and then through open clamp through which cable passes before giving around pin. Presses right pedal to close staking press and then left pedal to cut cable. Lays cable on work bench. Counts cables and ties in bundles of 100 with reinforced paper tie.

3. Grinds and reams conduits: Grinds outside ends of lengths of conduit to taper them for insertion in caps by manually rotating conduit as end is held against wheels of bench grinder. Reams both ends of lengths of conduit by inserting in guide and pushing over rotating drill to ream inside diameter for easy insertion of cable.

4. Strands cables: Picks up two or more cable ends and enters them into ends of several conduits, pushing all cables held in hand at same time. Twists strands together with fingers if they are spread so as not to enter conduit. Wipes excess grease from large cable ends that have been pushed through conduit, using rag. Walks to work table to secure bundles of large cables and carries them to work station. Carries completed cables to next work station or places them in tray.

5. Swages terminal and cuts excess cable: Pushes terminal on cable by hand, stakes it in position under dies of foot-operated press and enters each terminal end in opening of swager twice. Checks outside diameter of terminal after swaging with fixed gauge. Rejects cables with ends too large to accept terminals. Cuts excess cable extending beyond terminal by inserting excess between cutting jaws, taking care to hold cable at right angle to jaws, and step on pedal to cut off end.

6. Assembles parts: Takes one cable with conduit and fittings from pile on table and one hook from pile. Slips hook tube on cable end and lays assembly in fixture. Lifts one pin from pile on right and lays in curve of hook while holding cable and hoop in fixture with left hand. Presses pedal to close press and secure hook around top of pin at the same time hook tube is staked on cable.

7. Tests cables: Tests completed cables for length and secure fastening of fittings by placing one end of cable in notch or over pin, or working with another worker who does this part of the job when testing long cables, and connects other end to a hydraulic or mechanical device which applies a controlled force. Watches gauge to determine stretch or watches weighted lever when testing small cables to note how far lever falls. Discards cables which fail tests and cuts on press with cutting dies, if defect is not repairable, to avoid use as a brake cable. Tests some brake cables by compression of conduit at same time cable is tested.

Effectiveness of Norms

Only 64% of the nontest-selected workers used for this study were good workers; of the workers had been test-selected with the S-408 norms, 87% would have been good workers. 36% of the nontest-selected workers used for this study were poor workers; if the workers had been test-selected with the S-408 norms only 13% would have been poor workers.

Applicability of S-408 Norms

The aptitude test battery is applicable to jobs which include a majority of the duties described above.

GPO 941-088

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