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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 signicant 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)

TECHNICAL REPORT

ON

# STANDARDIZATION OF THE GENERAL APTITUDE TEST BATTERY

FOR

## ROTARY-DRILLER HELPER (petrol. production) 7-75.050

B-608 S-328



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

December 1964

GATB # 2532

# STANDARDIZATION OF THE GENERAL APTITUDE TEST BATTERY

FOR

# ROTARY-DRILLER HELPER (petrol. production) 7-75.050

B-608 S-328

## Summary

The General Aptitude Test Battery, B-1002, was administered to a final sample of 53 men enrolled as Rotary-Driller Helpers (pet. prod.) 7-75.050 in an MDTA training course, at Anadarko Basin School of Rig Crew Training, Spearman Independent School District, Spearman, Texas. The criterion consisted of descriptive-rating scale scores based on classroom instructor's ratings and drilling rig instructor's ratings. On the basis of mean scores, standard deviations, correlations with the criterion, job analysis data, course description, and their combined selective efficiency, Antitudes S-Spatial Aptitude, P-Form Perception and M-Manual Dexterity were selected for inclusion in the final test norms.

GATB Norms for Rotary-Driller Helper (pet. prod.) 7-75.050, B-608. S-328

| B-1001 | | | B-1002 | | |
|---|---|---|---|---|---|
| Aptitude | Tests | Minimum Acceptable Aptitude Score | Aptitude | Tests | Minimum Acceptable Aptitude Score |
| S | CB-1- F<br>CB-1- H | 90 | S | Part 3 | 85 |
| P | CB-1- A<br>CB-1- L | 95 | P | Part 5<br>Part 7 | 95 |
| M | CB-1- M<br>CB-1- N | 90 | M | Part 9<br>Part 10 | 85 |

## Effectiveness of Norms

The data in Table IV indicate that only 68 percent of the non-test-selected trainees used for this study were good trainees; if the trainees had been test-selected with the above norms, 88 percent would have been good trainees. 32 percent of the non-test-selected trainees used for this study were poor trainees; if the trainees had been test-selected with the above norms, only 12 percent would have been poor trainees.

TECHNICAL REPORT

## I. Purpose

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 Rotary-Driller Helper (pet. prod.) 7-75.050.

## II. Sample

The General Aptitude Test Battery, B-1002, was administered between March 1964 and July 1964 to 60 males enrolled as Rotary-Driller Trainees at Anadarko Basin School of Rig Crew Training, Spearman Independent School District, Spearman, Texas. Seven cases were eliminated from the sample for failure either to enroll or to complete the course. The balance of 53 trainees constitute the final sample.

The training was given to prepare trainees for employment as Rotary-Driller Helper, 7-75.050. None of the trainees had previous experience in the occupation. Drilling contractors have estimated that approximately three months of on-the-job training are required to become proficient on the job. This is an intensive six-week training course which represents about one-half the required learning time.

Individuals were selected for training on the basis of being within the acceptable age range, willingness to change residence and to travel between various rig locations on field trips. Although some trainees were selected from among applicants who had already been given the GATB, most of the sample were tested at some time after entering the course, and test scores were not considered in selection.

TABLE I

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

| N = 53 | M | $\sigma$ | Range | r |
|---|---|---|---|---|
| Age (years) | 22.8 | 5.2 | 18-40 | -.364** |
| Education (years) | 11.5 | 1.4 | 7-14 | .062 |

**Significant at the .01 level

III. Job Description

Job Title: Rotary-Driller Helper (petrol. production) 7-75.050

Job Summary: Performs manual tasks in back-up, lead-tong, or pipe-rack positions, working in teamwork as member of two or three-man crew on drilling floor to assist in oil or gas well drilling operations and in running drill-pipe and casing into and out of well.

Work Performed: Works in back-up position to attach and latch back-up tongs on drill-pipe or casing, preventing pipe from turning while force is applied to lead-tongs in tightening or loosening joints: Sets slip (curved metal wedges) around pipe to hold sections in desired position in rotary table and to prevent them from dropping in well. Assists in guiding lower end of pipe sections which are suspended by elevators on hoist line in order to move pipe to and from rack.

Works in lead-tong position to attach and latch lead-tongs to sections of drill-pipe and casing in order to tighten and loosen joints in running pipe into and out of well: Lead-tongs are connected by cable to cathead on draw works (hoisting mechanism) which is operated by Rotary Driller to apply force to tongs. Pulls hoist line to raise and lower tongs from lower to upper sections of pipe. Oils and greases rotary table, and joints of pipe sections. In two-man crew the duties of lead-tong position are divided between back-up and pipe-rack positions.

Works in pipe-rack position to rack and unrack sections of drill-pipe as they are raised from or lowered into well: Guides lower end of pipe sections to and from rack, assisted by other Rotary-Driller Helpers, while upper end is handled by Derrickman I. Positions (stobs) threaded end of suspended section into collar of previous section to engage threads. Throws end of chain, attached to lead-tong line, around upper pipe sections and holds end of chain while Rotary-Driller operates cathead, turning pipe to thread it into collar in joining sections to go into well. Sets slip in teamwork with other worker in back-up position.

Performs miscellaneous duties: Assists Derrickman I to mix clay and water in preparing slush that is circulated through well. Assists Cathead Man when using cathead to move or hoist equipment or materials. Periodically reads gage indicating pressure on tools at bottom of well and reports irregularities to Rotary Driller. Digs ditches, racks tools, and cleans up drilling floor around rig. Assists in setting up and making repairs to drilling machinery, slush pumps, and derrick.

IV. Experimental Battery

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

V. Criterion

The criterion consisted of instructors' ratings using USES Form SP-21, "Descriptive Rating Scale." Independent ratings were made by the classroom instructor and the drilling rig instructor. The drilling rig instructor is an experienced driller. His training consisted of practice exercises in actual work performed in operation of a rig. His ratings, representing judgments projecting observed work performed to an estimate of probable job success, were desirable because of their close relationship to actual job performance. A reliability coefficient of .70 was obtained for the criterion. Therefore, the two sets of ratings were combined, resulting in a distribution of final scores of 24-77, with a mean of 55.6 and a standard deviation of 11.3.

The criterion was collected from October 1964 through November 1964 and covers the period March - July 1964.

VI. Qualitative and Quantitative Analyses

A. Qualitative Analysis

On the basis of the job analysis data, the following aptitudes were rated "important" for success in this occupation:

Intelligence (G) - Required to learn complex work procedure and to apply required methods in varying work situations while engaged in close teamwork with other Rotary-Driller Helpers.

Spatial Aptitude (S) - Required to think visually of spatial relationships while rapidly placing tools and pipe in position, and to be constantly aware of the spatial location of other workers, tools, and materials.

Form Perception (P) - Required to detect defects in threads or cracks in pipe and drill collars by visual inspection; to make selection of proper hand tool in tightening nuts in installing blowout preventer and doing minor repair work in assisting Rotary Driller.

Manual Dexterity (M) - Required to use hands rapidly and accurately to meet speed requirements for breaking or making up drill pipe and to coordinate activities safely in teamwork with others.

Aptitudes V-Verbal Aptitude and Q-Clerical Perception were rated "irrelevant" for success in this occupation.

B. Quantitative Analysis:

TABLE II

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

| Aptitudes | M | $\sigma$ | r |
|---|---|---|---|
| G-Intelligence | 100.7 | 14.6 | .308* |
| V-Verbal Aptitude | 96.6 | 15.4 | .240 |
| N-Numerical Aptitude | 94.3 | 15.0 | .177 |
| S-Spatial Aptitude | 108.6 | 14.8 | .394** |
| P-Form Perception | 102.4 | 18.9 | .314* |
| Q-Clerical Perception | 98.9 | 13.6 | .370** |
| K-Motor Coordination | 100.2 | 19.7 | .133 |
| F-Finger Dexterity | 96.1 | 19.0 | .452** |
| M-Manual Dexterity | 116.0 | 23.7 | .287* |

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

C. Selection of Test Norms:

TABLE III

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 | | X | | | | X | | | |
| Relatively High Mean | | | | X | X | | | | X |
| Relatively Low Sigma | X | | X | X | | X | | | |
| Significant Correlation with Criterion | X | | | X | X | X | | X | X |
| Aptitudes to be Considered for Trial Norms | X | | | X | X | | | X | X |

Trial norms consisting of various combinations of Aptitudes G, S, P, F, and M with appropriate cutting scores were evaluated against the criterion by means of the Phi Coefficient technique. A comparison of the results showed that B-1002 norms consisting of S-85, P-95 and M-85 had the best selective efficiency.

## VII. Validity of Norms

The validity of the norms was determined by computing a Phi Coefficient between the test norms and the criterion and applying the Chi Square test. The criterion was dichotomized by placing approximately one-third of the sample in the low criterion group because this group was considered to be the less successful trainees.

Table IV shows the relationship between the test norms consisting of Aptitudes S, P, and M with the critical scores of 85, 95, and 85, respectively.

Trainees in the high criterion group have been designated as "good trainees" and those in the low criterion group as "poor trainees."

TABLE IV

Validity of Test Norms for
Rotary-Driller Helper 7-75.050
(S-85, P-95, M-85)

| N=53 | Non-Qualifying Test Scores | Qualifying Test Scores | Total |
|---|---|---|---|
| Good Trainees | 8 | 28 | 36 |
| Poor Trainees | 13 | 4 | 17 |
| Total | 21 | 32 | 53 |

Phi Coefficient = .518
$X^2$ = 14.199
P/2 < .0005

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

## VIII. Conclusions

On the basis of the results of this study, Aptitudes S, P and M with minimum scores of 85, 95 and 85, respectively, are recommended as B-1002 norms for Rotary-Driller Helper (pet. prod.) 7-75.050. The equivalent B-1001 norms consist of S-90, P-95 and M-90.

IX. 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 Guide to the Use of the General Aptitude Test Battery, January 1962. The data for this sample will be considered for future groupings of occupations in the development of new occupational aptitude patterns.