DOCUMENT RESUME

ED 065 565 TM 001 752

TITLE	Roofer, Composition (const.) 7-31.100--Technical Report on Standardization of the General Aptitude Test Battery.
INSTITUTION	Manpower Administration (DOL), Washington, D.C. U.S. Training and Employment Service.
REPORT NO	S-241
PUB DATE	Mar 63
NOTE	10p.
EDRS PRICE	MF-$0.65 HC-$3.29
DESCRIPTORS	*Aptitude Tests; Construction (Process); *Cutting Scores; Evaluation Criteria; Job Applicants; *Job Skills; Norms; Occupational Guidance; *Personnel Evaluation; *Roofers; Test Reliability; Test Validity; Trade and Industrial Education
IDENTIFIERS	GATB; *General Aptitude Test Battery

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)

1710

TECHNICAL REPORT

ON

STANDARDIZATION OF THE GENERAL APTITUDE TEST BATTERY

FOR

ROOFER, COMPOSITION (const.) 7-31.100

B-518 S-241

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

March 1963

1710

GATB # 2404

STANDARDIZATION OF THE GENERAL APTITUDE TEST BATTERY

FOR

ROOFER, COMPOSITION (const.) 7-31.100

B-518

Summary

The General Aptitude Test Battery, B-1002A, was administered to a final sample of 50 male Roofer Apprentices 7-31.100 employed at 33 firms and attending 3 trade schools for supplemental and related instruction in the San Francisco Bay area in California. The criterion consisted of supervisory ratings. On the basis of mean scores, standard deviations, correlations with the criterion, job analysis data, and their combined selective efficiency, Aptitudes P-Form Perception, K-Motor Coordination and M-Manual Dexterity were selected for inclusion in the final test norms.

GATB Norms for Roofer, Composition 7-31.100, B-518

B-1001			B-1002		
Aptitude	Tests	Minimum Acceptable Aptitude Score	Aptitude	Tests	Minimum Acceptable Aptitude Score
P	CB-1-A CB-1-L	70	P	Part 5 Part 7	70
T	CB-1-G CB-1-K	65	K	Part 8	70
M	CB-1-M CB-1-N	80	M	Part 9 Part 10	80

Effectiveness of Norms

The data in Table IV indicate that 10 of the 15 poor workers, or 67 percent of them, did not achieve the minimum scores established as cutting scores on the recommended test norms. This shows that 67 percent of the poor workers would not have been hired if the recommended test norms had been used in the selection process. Moreover, 32 of the 37 workers who made qualifying test scores, or 87 percent, were good workers.

1710

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 Roofer, Composition 7-31.100.

II. Sample

The GATB, B-1002A, was administered between May 25, 1960, and February 16, 1961, to 75 Roofer Apprentices during evening classes in required related and supplemental instruction. Of these 75, one had a fourth grade education; one was employed as a roofing materials saleman; one was the job foreman and would have rated himself; one would have been rated by his father; one had completed his apprenticeship 5 years prior; 12 had left the trade; and 8 had not been employed long enough by any one firm to receive a rating. Twenty-five subjects were therefore eliminated from the final sample. Thus, the final sample consisted of 50 male apprentices. The planned apprenticeship program is for three years with a minimum of 288 hours of related classroom instruction. The first year of work and related classroom instruction is devoted primarily to tar and gravel and composition roofing. One year is the minimum training period required to perform as Roofer, Composition, 7-31.100. Therefore, each individual contained in the sample has at least one year of experience. No tests are used by the Joint Apprenticeship Committees in selection of Apprentices. Applicants are referred to a Committee by an employer, or a Committee holds open recruitment. Applicants complete a standard application form and are interviewed by the Committee and, if found acceptable on the basis of interest in the trade and willingness to learn and complete the apprenticeship period, are then formally indentured. There is no education requirement, and applicants must be at least 18 years of age and no more than 25 years of age, though under some circumstances maximum age is extended.

The various companies cooperating in the study were in three Joint Apprenticeship Committees in the San Francisco Bay Area.

Participating Establishments

Raker Roofing Co., Belmont
Malott & Peterson Roofing, Berkeley
Ed Castagnetto Roofing Co., Inc., Colma
Aetna Roof Service, Colma
Caldwell Roofing Co., Concord
Dan Goodwin Co., Daly City
W. R. Crowe Co., El Cerrito
Rogers & Ostrander Inc., El Sobrante
Beck Roofing Co., Hayward
B & W Roofing Co., Hayward
McFarland Roofing Co., Hayward
W. Thomas Roofing Co., Oakland
Sun Roofing Co., Oakland
Star Roofing Co., Oakland
Caldwell-Roland Roofing Co., Oakland
Elliott & Elliott Roofing Co., Oakland
Apollo Roofing Co., Oakland
General Roofing Co., Oakland
Roof Maintenance Co., Oakland
L. W. West Roofing Co., Palo Alto
A & P Roofing Co., Redwood City
Alta Roofing, San Francisco
Regal Roofing, San Francisco
Western Roofing Service, San Francisco
General Roof Servicing Co., San Francisco
Bender Roofing Inc., San Francisco
Mid-State Roofing, San Jose
Acme Roofing, San Jose
Agar Roof & Tile Co., San Jose
John B. Shelton Roofing Co., San Jose
Compouris & Matoza Roofing Co., San Leandro
Associated Roofing Co., South San Francisco
Contra Costa Roofing, Walnut Creek

1710

The apprentices who were attending classes at Laney Trade School in Oakland, O'Connell Trade School in San Francisco, & San Jose City College volunteered to be tested for the study.

TABLE I

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

N = 50	M	σ	Range	r
Age (years)	25.7	4.1	18-35	.224
Education (years)	10.6	1.6	7-14	.188
Experience (months)	29.0	6.6	15-36	-.016

1710

III. Job Description

Job Title: Roofer, Composition (const.) 7-31.100

A. Job Summary: Lays roll roofing and mineral surfaced asphalt shingles and cap-sheet to surface or resurface roof decks. Cuts roofing paper, mineral surface asphalt shingles, and other roofing materials such as insulation and flashing to fit roof corners, angles, around pipes, vents, chimneys or other projections on roof using a knife. Lays and fastens shingles to roof deck using nails or hot asphalt. Mops overlapping joints with hot asphalt to seal them. Cements or nails flashing to eaves, rake edges, hips and ridges. Seals all joints and flashings using plastic, mastic or other sealants. Spreads gravel over hot asphalt using shovel or rake. Trims composition and flashing at edges and where roof sections intersect. Scans roof for marks, scratches, tears or any weak points which require attention.

B. Work Performed: Sets up equipment and prepares new deck for roofing and old deck for reroofing. Hoists materials to roof, sets drains and flashing and surfaces and resurfaces roofs with roll roofing and mineral surfaced asphalt shingles. Loads and unloads equipment from truck.

1. Sets up equipment: Positions ladder against wall; positions power or manually operated derrick on ground; and attaches A-frame or derrick boom to roof.

2. Prepares deck for roofing: Nails metal over holes or cracks to prevent hot asphalt seepage and fills depressions to make surface level on new deck. Hammers protruding nails flush with roof surface and sands high spots on wood or concrete deck to prevent piercing of roofing paper. Sweeps deck to remove dirt and foreign objects and to insure adhesion of roofing materials. Spuds gravel, flashing, composition shingles, nails, insulation board and felt from old deck. Cuts blisters in old roofing paper with knife, and nails cut edges securely when new roof is to be applied directly to old roofing paper.

3. Hoists materials to roof: Attaches hook and hoists materials to roof by pulling rope on pulley attached to A-frame or manipulates levers of power hoist located on ground or truck. Occasionally carries materials up ladder on one-story buildings. Places materials on roof as near as possible to place where they will be used. Places roofing paper (felt), gravel, insulation, flashing or composition shingles needed for each section of roof in work area. Spaces heavy materials on roof along hips and ridges to prevent overloading.

4. Sets drains and flashing: Nails cant strips in angle formed by intersection of deck and parapet when needed for drainage. Removes mastic and asphalt from pipes and metal flanges of vents when rust or holes are observed in metal and removes nails before setting drains on old deck. Replaces metal sleeves and collars, slips felt under flanges, embeds vents in mastic and renails at edges of flanges. Sets drains flush with or below roof sheathing and nails at edges of flange and sets sleeves or collars over felt on vents and pipes and embeds then in mastic. Installs or replaces metal coping, gutters, reglet flashing and other flashing as specified.

5. Surfaces and resurfaces wood, metal and concrete decks: Rolls out sheets of base felt on deck leaving a turn-up at angles, rake edges and eaves of roof, and nails felt to wood sheathing to prevent asphalt from seeping through boards and damaging the interior ceiling. Spreads primer on concrete decks with trowel and allows it to dry before applying hot asphalt. Mops hot asphalt evenly on base felt or primed concrete deck where next layer of roofing paper is to be laid. Rolls out next sheet of paper smoothing it with broom or feet to insure airtight adhesion. Occasionally uses Rolling Rod when laying sheets of roofing paper. Applies hot asphalt and paper in alternate layers until roof is built up to specifications. Cuts, folds and miters felt to fit into corners, angles and around pipes, vents and other projections. Fits turn-up tightly into angles and nails to wall; cuts and folds corners and trims overhang at rake edges and eaves. Applies mastic to assure waterproof joints. Embeds insulation board in hot asphalt over roofing paper and hot asphalt over insulation as specified to complete the roof build up. Mops thick coating of hot asphalt over last layer of paper and spreads thick layer of gravel with shovel and rake over hot asphalt to complete roof build-up; or, back-mops capsheet, flops and aligns sheet in hot asphalt at eaves, overlaps strips of capsheet after back-mopping to cover roof, and nails strips to complete roof build-up. Trims capsheet and nails flashing at rake edges, eaves and along hips and ridges as specified when entire roof is covered. Applies plastic flashing compound over all nail heads to seal them. Lays valley sheet parallel to valley when applying mineral surfaced asphalt shingles on roof with valleys. Flashes valley, overlaps specified layers of shingles, or rolls heavy single strip of capsheet in valley for drainage. Lays shingles starting at eaves and working towards ridge. Lays starter strip by nailing shingles along edge of roof end to end. Laps, measuring for placement of shingles using preset gauge attached to Roofers' Hatchet, and nails shingles to cover roof deck. Cuts, folds and miters shingles to fit into corners, angles and around pipes, vents and other projections. Trims and flashes ridges, eaves, rake edges and hips as specified. Scans roof surface for marks, scratches, tears, or any weak points that require attention.

6. Performs miscellaneous duties: Assists in unloading materials from truck at start of work shift and loading materials onto truck at completion of work shift. Nails Shinglers' Bracket to roof for foot hold and moves and renails bracket as necessary.

B. Course Description

1. Formulation of the apprenticeship system and standards for apprenticeship in roofing.

2. Safety measures and principles in handling roofing materials, equipment and working on roofs.

3. Federal and State laws providing benefits and protection for the worker.

4. Ethics and attitudes of the roofer toward employers, fellow employees and the public.

1710

5. Roofing and architectural trade terms and their definitions.

6. Basic mathematics and mensuration for roofers. (Learn to add, subtract, multiply and divide whole numbers, fractions, percentages, decimals and fractional equivalents. Learn expressions of dimensions and do computations using dimensions.)

7. Use of roofers' tools, equipment and supplies; and procedures, processes and methods used by the roofer.

8. Blueprints and their use and an introduction to estimating. (The apprentices learn the purpose blueprints serve but do not learn how to use them. In estimating, they learn principles used in estimating type of roof needed, amount of materials required and cost of roof to be applied.)

IV. Experimental Battery

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

V. Criterion

The two criterion measures collected for this study consisted of supervisory ratings and school instructors' ratings, each based on modifications of the Descriptive Rating Scale, Form SP-21, developed by the United States Employment Service. Two ratings, 14 days or more apart, were made by the immediate work foreman of each apprentice and by each of the three school instructors on the apprentices enrolled in his class. The rating scale completed by the school instructors consisted of nine items covering different aspects of classroom performance, with five alternatives for each item. The rating scale completed by the immediate work foreman consisted of nine items covering various aspects of on-the-job performance, with five alternatives for each item. Weights of one through five indicating the degree of proficiency attained were assigned to each alternative on each scale.

A Pearson product-moment correlation coefficient of .957 was obtained between the two sets of school instructors' ratings. The ratings were then combined and yielded a distribution of combined scores from 18 through 90 with a mean of 59.44 and a standard deviation of 20.32.

A Pearson product-moment correlation coefficient of .879 was obtained between the two sets of work foreman ratings. The ratings were then combined and yielded a distribution of combined scores of 41 through 89 with a mean of 60.60 and a standard deviation of 10.71.

A Pearson product-moment correlation was computed between combined school instructors' ratings and combined supervisory ratings. The correlation coefficient obtained was .243, indicating the two criterion measures were measuring different aspects of performance. Therefore, the two criteria were not combined into a single measure for validation purposes. Pearson product-moment correlations with each of the aptitudes of the GATB were computed for each criterion separately, and the selective efficiency of trial

1710

norms was evaluated against a dichotomized multiple hurdle criterion for which a critical score was set on each criterion. The critical score on each criterion was set at one standard deviation below its mean and rounded to the nearest whole number. The standard deviation of each criterion was chosen so that the obtained critical scores, when applied to the data, would result in placing approximately one-third of the sample in the low criterion group. Application of this technique resulted in setting a critical score of 50 on the combined work ratings and 39 on the combined school ratings. A worker had to equal or exceed both critical scores in order to be placed in the high criterion group. In applying these critical scores, 15 of the 50 workers, or 30 percent of them, were placed in the low criterion group.

VI. Qualitative and Quantitative Analyses

A. Qualitative Analysis:

The job analysis indicated that the following aptitudes measured by the GATB appear to be important for this occupation:

Form Perception (P) - required on the job to fit materials within spaces laid out on roof and to maintain uniform spacing or overlapping.

Motor Coordination (K) - required on the job for measuring and aligning composition shingles, felt or flashing, and in nailing and removing nails, shingles and felt.

Manual Dexterity (M) - required on the job in using hand tools skillfully and manipulating roofing materials.

On the basis of the job analysis data, aptitudes V-Verbal Aptitude and Q-Clerical Perception were considered as "irrelevant" for successful performance of the job.

1710

B. Quantitative Analysis:

TABLE II

Means (M), Standard Deviations (σ), and Pearson Product-Moment Correlations with the Criteria Combined Work Ratings (r^1) and Combined School Ratings (r^2) for the Aptitudes of the GATB; N = 50

Aptitudes	M	σ	r^1	r^2
G-Intelligence	88.9	14.9	.162	.539**
V-Verbal Aptitude	86.2	13.2	.232	.509**
N-Numerical Aptitude	84.9	17.3	.077	.545**
S-Spatial Aptitude	97.8	18.8	.166	.377**
P-Form Perception	90.2	19.6	.331*	.496**
Q-Clerical Perception	90.6	13.2	.245	.487**
K-Motor Coordination	94.1	17.8	.335*	.284*
F-Finger Dexterity	97.5	18.5	.383**	.381**
M-Manual Dexterity	99.6	19.1	.608**	.366**

**Significant at the .01 level
*Significant at the .05 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
Irrelevant		X				X			
Relatively High Mean				X				X	X
Relatively Low Sigma	X	X				X			
Significant Correlation with Criterion	X	X	X	X	X	X	X	X	X
Aptitudes to be Considered for Trial Norms	G		N	S	P		K	F	M

Trial norms consisting of various combinations of Aptitudes G,N,S,P,K,F & 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 P-70, K-70 and M-80 had the best selective efficiency.

1710

VII. Validity of Norms (Concurrent)

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 30 percent of the sample in the low criterion group because this percent was considered to be the unsatisfactory or marginal workers.

Table IV shows the relationship between test norms consisting of Aptitudes P, K and M with critical scores of 70, 70 and 80, respectively, and the dichotomized criterion for Roofer, Composition 7-31.100. Workers in the high criterion group have been designated as "good workers" and those in the low criterion group as "poor workers."

TABLE IV

Validity of Test Norms for Roofer, Composition 7-31.100
(P-70, K-70, M-80)

N = 50	Non-Qualifying Test Scores	Qualifying Test Scores	Total
Good Workers	3	32	35
Poor Workers	10	5	15
Total	13	37	50

Phi Coefficient = .61
χ^2 = 18.420
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 P, K and M with minimum scores of 70, 70 and 80, respectively, have been established as B-1002 norms for Roofer, Composition 7-31.100. The equivalent B-1001 norms consist of P-70, T-65, and M-80.

IX. Determination of Occupational Aptitude Pattern

The specific norms established for this study did not meet the requirements for allocation to any of the existing 35 OAP's (revised 10/61). The data for this sample will be considered for future groupings of occupations in the development of new occupational aptitude patterns.