DOCUMENT RESUME

ED 061 329 TM 001 557

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|---|---|
| TITLE | Trailer-Tank-Truck Driver (petrol. refin; ret. tr.; whole. tr.) 903.883; Tractor-Trailer-Truck Driver (any ind.) 904.883--Technical Report on Development of USES Aptitude Test Battery. |
| INSTITUTION | Manpower Administration (DOL), Washington, D.C. U.S. Training and Employment Service. |
| REPORT NO | TR-S-124 |
| PUB DATE | Mar 66 |
| NOTE | 13p. |
| EDRS PRICE | MF-$0.65 HC-$3.29 |
| DESCRIPTORS | *Aptitude Tests; *Cutting Scores; Evaluation Criteria; Job Applicants; *Job Skills; *Motor Vehicles; Norms; Occupational Guidance; *Personnel Evaluation; Test Reliability; Test Validity |
| IDENTIFIERS | GATB; *General Aptitude Test Battery; Truck Driver |

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 describes 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 also included. (AG)

Technical Report on Development of USES Aptitude Test Battery

For .....

Trailer-Tank-Truck Driver (petrol. refin.; ret. tr.; whole. tr.) 903.883
Tractor-Trailer-Truck Driver (any ind.) 904.883

S-124



U. S. Employment Service
in Cooperation with
Iowa and Pennsylvania State Employment Services

March 1966

GATB Study #2174

# DEVELOPMENT OF USES APTITUDE TEST BATTERY

For

Trailer-Tank-Truck Driver (petrol. refin.; ret. tr.; whole. tr.) 903.883
Tractor-Trailer-Truck Driver (any ind.) 904.883

S-124

This report describes research contributing to the development of General Aptitude Test Battery (GATB) norms for the occupation of Tractor-Tank-Truck Driver (any ind.) 904.883. The following norms were established:

| GATB Aptitudes | Minimum Acceptable GATB, B-1002 Scores |
|---|---|
| G - General Learning Ability | 85 |
| V - Verbal Aptitude | 80 |
| N - Numerical Aptitude | 90 |
| Q - Clerical Perception | 80 |

## RESEARCH SUMMARY

Sample:
50 male employees of the Des Moines, Iowa terminal of the Ruan Transport Corporation working as Trailer-Tank-Truck Drivers make up the validation sample for this study.

Criterion (validation study):
Supervisory ratings

Design (validation study):
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 for Validation Study: Phi Coefficient = . 50 ($P/2 < .0005$)

Effectiveness of Norms:

Only 66% of the non-test-selected workers used for this sample were good workers; if the workers had been test-selected with the above norms, 82% would have been good workers. 34% of the non-test-selected workers used for this sample were poor workers; if the workers had been test-selected with the above norms, only 18% would have been poor workers. The effectiveness of the norms is shown in Table 1:

Table 1

Effectiveness of Norms - Validation Sample

| | Without Tests | With Tests |
|---|---|---|
| Good Workers | 66% | 82% |
| Poor Workers | 34% | 18% |

## VALIDATION SAMPLE DESCRIPTION

Size: N = 50

Occupational Status: Employed workers

Work Setting: Employed at the Des Moines, Iowa Terminal of the Ruan Transport Corporation, Des Moines, Iowa.

Employer Selection Requirements:

Education: Prefer high school graduates but this has not been a strict hiring requirement.

Previous Experience: No specified requirement but a preference for at least two years of experience.

Tests: None

Other: Personal interview, reference check and a physical examination.

Principal Activities: The job duties are comparable to those shown in the job descriptions in the Appendix. (Note that job descriptions are shown for both the Validation and Cross-Validation Samples and the Course Outline is shown for the Cross-Validation Sample. However, the description for the Cross-Validation Sample is more comprehensive and has been used for the Fact Sheet.)

Minimum Experience: All workers had completed an on-the-job training period of at least 6 months.

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) | 27.8 | 6.0 | 25-47 | .027 |
| Education (years) | 10.8 | 1.8 | 6-15 | .183 |
| Experience (months) | 59.8 | 44.5 | 7-175 | .068 |

## EXPERIMENTAL TEST BATTERY

All 12 tests of the GATB, B-1002A were administered during the period March-April 1957 to the validation sample.

## CRITERION

The criterion for the validation sample consisted of rank order supervisory ratings (converted to linear scores with a mean of 50 and a standard deviation of 19.1). Ratings and reratings for each worker were made at approximately the same time as the tests were administered with a time interval of two weeks between the ratings.

Reliability: The coefficient of reliability between the two ratings is .88. The final criterion consisted of the initial ratings.

Criterion Dichotomy: The criterion distribution was dichotomized into high and low groups by placing 34% 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 42.

## APTITUDES CONSIDERED FOR INCLUSION IN THE NORMS

Aptitudes were selected for tryout in the norms on the basis of a qualitative analysis of job duties involved and a statistical analysis of test and criteric data. Tables 3, 4 and 5 show the results of the qualitative and statistical analysis.

Table 3

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

| Aptitude | Rationale |
|---|---|
| G - General Learning Ability | Necessary to learn and understand the various delivery operations performed; to be able to make sound judgments in cases involving deviations from standard procedure. |
| V - Verbal Aptitude | Necessary to read and understand the various printed instructions contained in the drivers' manuals and to write reports properly. |
| N - Numerical Aptitude | Necessary to make accurate computations in the determination of the amount of petroleum that can be loaded and legally carried; in determining amounts delivered; and in pricing petroleum products. |
| Q - Clerical Perception | Necessary to prepare reports and orders accurately and to avoid making perceptual errors in arithmetic computations. |

Table 4

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

| Aptitudes | Mean | SD | Ranges | r |
|---|---|---|---|---|
| G - General Learning Ability | 100.2 | 12.7 | 94-128 | .479** |
| V - Verbal Aptitude | 97.4 | 13.3 | 74-131 | .374** |
| N - Numerical Aptitude | 97.3 | 13.9 | 64-124 | .522** |
| S - Spatial Aptitude | 98.2 | 14.7 | 68-124 | .321* |
| P - Form Perception | 86.4 | 14.5 | 54-119 | .214 |
| Q - Clerical Perception | 92.7 | 9.9 | 61-120 | .401** |
| K - Motor Coordination | 96.5 | 18.8 | 49-140 | .249 |
| F - Finger Dexterity | 98.9 | 15.0 | 67-132 | .259 |
| M - Manual Dexterity | 101.1 | 22.9 | 56-158 | .117 |

** Significant at the .01 level
* Significant at the .05 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 | | | | | | | | | |
| Relatively High Mean | X | | | X | | | | X | X |
| Relatively Low Standard Dev. | X | X | X | | | X | | | |
| Significant Correlation with Criterion | X | X | X | X | | X | | | |
| Aptitudes to be Considered for Trial Norms | G | V | N | S | | Q | | | |

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, V, N, S and Q, at trial cutting scores were able to differentiate between 66% of the sample considered good workers and 34% 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 1/3 of the sample with three-aptitude norms. For two-aptitude trial norms, minimum cutting scores of slightly more than one standard deviation below the mean will eliminate about 1/3 of the sample; for four-aptitude trial norms, cutting scores of slightly less than one standard deviation below the mean will eliminate about 1/3 of the sample. The Phi Coefficient was used as a basis for comparing trial norms. Norms of G-85, V-80, N-90 and Q-80 provided the highest degree of differentiation. 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 for Validation Sample (G-85, V-80, N-90, Q-80

| | Nonqualifying Test Scores | Qualifying Test Scores | Total |
|---|---|---|---|
| Good Workers | 5 | 28 | 33 |
| Poor Workers | 11 | 6 | 17 |
| Total | 16 | 34 | 50 |

Phi Coefficient ($\emptyset$) = .50 Chi Square ($X^2$) = 12.65

Significance Level = $P/2 < .0005$

## DETERMINATION OF OCCUPATIONAL APTITUDE PATTERN

The data for this study met the requirements for incorporating the occupation studied into OAP-19 which is shown in Section II of the Guide to the Use of the General Aptitude Test Battery.

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S-124 - Tractor-Trailer-Truck Driver (any ind.) 904.883

Check Study Research Summary

Sample:

92 male Tractor-Trailer Truck Driver trainees enrolled in an MDTA course at Bedford High School, Bedford, Pennsylvania.

TABLE 7

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

| | Means | SD | Range | r |
|---|---|---|---|---|
| Age (years) | 29.6 | 5.4 | 21-43 | -.108 |
| Education (years) | 10.9 | 1.4 | 7-15 | .065 |

Criterion:

Instructor's ratings made on an adaptation of Form SP-21, "Descriptive Rating Scale."

Principal Activities:

The job duties for each workers are comparable to those shown in the job description (Fact Sheet) in the Appendix.

Predictive Validity:

Phi Coefficient ($\phi$) = .32 ($P/2 < .005$)

Effectiveness of Norms:

Only 65% of the non-test-selected trainees in this sample were good trainees; if the trainees had been test-selected with the S-124 norms, 76% would have been good trainees. 35% of the non-test-selected trainees in this sample were poor trainees; if the trainees had been test-selected with the S-124 norms, only 24% would have been poor trainees. The effectiveness of the norms is shown in Table 8.

TABLE 8

Effectiveness of S-124 Norms on Check Study Sample

| | Without Test | With Tests |
|---|---|---|
| Good Trainees | 65% | 76% |
| Poor Trainees | 35% | 24% |

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

Job Description for Validation Sample

Job Title: Trailer-Tank-Truck Driver (petrol. refin.; ret. tr.; whole. tr.) 903.883

Job Summary: Under limited supervision operates tractor-trailer units to deliver petroleum products to bulk plants or to service stations. Determines load limits in loading and proper procedure to use in unloading. Prepares bills of lading and prices petroleum products.

Work Performed: Picks up delivery orders, bulk plant keys and any additional instructions from mail box at beginning of shift. Fills out trip sheet as to destination, load origin, oil company, kind of delivery and product. Punches time out on time clock. Inspects tractor and trailer at onset and completion of driving; fills out vehicle condition report for each trip. Makes recommendations for any needed repair. Inserts tachograph record (a speed recording device) in proper place. Drives to pipeline terminal to load trailer. Determines total amount of petroleum that can be loaded on basis of state gross weight restrictions by figuring the present weight of the existing temperature. Determines maximum load for each axle, when necessary, by dividing wheel base of tractor into the fifth wheel setting (in inches) to determine percentage of weight on #1 anxle. Drives to unloading point, maintaining speed under specified maximum; stops at all railroad crossings; checks tires each 50 miles. Exercises extreme caution because of the volatile nature of the product carried. Reports all pertinent incidents encountered enroute, and all weighing stations passed whether truck is weighed or not. Delivers petroleum products either directly to bulk plant agent, on a "key-stop" basis, or directly to a dealer.

On the direct-to agent delivery, telephones agent when delivery town is entered if the agent is not regularly at the bulk plant. Drives into bulk plant location and positi truck for unloading. Connects grounding cable. Presents bill of lading to agent and receives instructions to begin unloading. Requests agent to break seals on truck trailer and proceeds to unload according to the printed instructions of the oil compa being served. Makes visual inspection to check for any overflow or loss of product. Discontinues unloading operation when it is jointly agreed that the truck is empty. Requests agent to sign bill of lading. Returns to terminal and checks in or drives t pipeline terminal for reloading.

Performs essentially the same preliminary duties as in direct-to agent delivery for "key-stop" delivery, except obtains key to bulk plant with delivery order and makes delivery without agent's being present. Positions truck for unloading and checks valve shed for verification order left by agent. Inventories bulk plant storage tank reading inchage gauge, if tank is so equipped, or by using measuring stick, and makes notation in terms of gallons on bill of lading. Unlocks valve locked with key-stop padlock and connects hose to unload. Places sample of product delivered and trailer truck tank seals in bulk plant valve shed.

Completes order as to gallons delivered and time required to unload. Computes demur rates to be charged bulk plant in unloading time exceeds allowable time due to fault bulk plant. Picks up order for next delivery. Drains trailer tank completely and checks truck's mechanical condition. Returns to terminal.

Performs direct-to dealer operation by using trailer unit which is divided into sever compartments and equipped with metering device. Positions truck in dealer service station according to pre-arranged plant for unloading. Removes fire extinguisher an places it in position for immediate use. Inventories all fuel storage tanks and ente readings on oil company order or bill of lading. Determines, by calculation, the am

of fuel to be delivered and fills storage tanks, using truck meter for measurement. Reports any spill to local fire department. Enters total amounts delivered and prices product according to price per gallon, state and federal tax, rent charges per gallon (if any), note liquidation per gallon (if any) and discount per gallon. Frequently collects amount due from dealer.

In all operations, conforms to federal, state, and local laws and customer rules and practices. May maintain I.C.C. log. Follows instructions exactly as contained in operational manual or as given verbally by company officials. Occasionally is tested for knowledge of contents of operational manuals. Writes detailed reports of any deviations from normal procedure, including any accidents involved in or witnessed. May make written recommendations for changes in company procedure.

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## SUPPLEMENTAL INFORMATION

Course Outline:

I. Classroom Instruction 120 hours

- A. Driver Regulations
- B. Driver Responsibilities
- C. Definition of Terms
- D. Function of Mechanical Unit
- E. Function of Driver in Relation to Power Unit
- F. Driver Responsibilities in Case of Fire or Accident
- G. Driver Responsibility in Relationship to Cargo
- H. Road Driving Safety

II. Driving Range Operations 120 hours

- A. Inspection of Equipment
- B. Checking Equipment
- C. Operating the Tractor
- D. Operating Tractor with Trailer Attached

Performance Requirements:

Responsibility

Must be able to accept responsibility for equipment and cargo valued up to $500,000. Incorrect judgment may result in loss of life and property. Driver must adhere to instructions and regulations and policies of employer. Must conduct company business and personal contacts with customers in such a manner as to assure customer satisfaction.

Job Knowledge

Must know I.C.C. Regulations and understand proper loading of cargo, distribution of cargo, axle weights, proper speeds, routes, terrain, etc. Must be able to determine proper functioning of tractor by visual inspection of equipment, instrument readings and sound of motor. Must be able to keep log and write required reports. Must be able to read and interpret manifest.

Mental Application

Must be able to plan work week in terms of day's run and plan loading of cargo to facilitate stops for unloading while at the same time insuring maximum capacity load without causing damage to cargo in transit. Must make independent judgments when motor trouble arises with respect to whether an attempt should be made to get the cargo into the terminal or whether to stop and ask for serviceman. Must be mentally alert and cautious at all times by keeping close watch on motor performance and paying close attention to traffic. Must have excellent reaction time in order to use brakes adequately to bring tractor-trailer to a dead stop in emergencies and to shift gears, double clutch and work gear shift sticks simultaneously with proper motor speeds in order to prevent damage to gears. Must make independent judgments with respect to speed on curves that is determined by such factors as type of load, method of packing, weight involved, top-heavy machinery, etc. Must be able to judge rate of speed.

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March 1966

FACT SHEET

Job Description for Cross-Validation Sample

Job Title: Tractor-Trailer-Truck Driver (any ind.) 904.883 (7-36.240)

Job Summary: Operates a diesel or gas-powered tractor-trailer to transport cargo consisting of materials, merchandise, equipment and drugs with cargo weights ranging from 3,000 to 35,000 pounds.

Work Performed: Inspects line haul sheet to obtain load weight and trailer and tractor identification number; compares numbers on dispatch sheet with equipment numbers to make certain proper tractor is coupled with proper trailer. Checks and notes type of load, perishables, degree of temperature required, frequency of defrosting; takes necessary steps to preserve load as indicated on line haul sheet instructions. Notes axle weights in three different areas in order to plan speed with respects to road terrain, down-grade speed and handling of rig to prevent accidents, cargo shift, etc.

Inspects tractor motor to determine type of motor and size of motor, i.e., W.B. - 28.504 cu. inch piston displacement, in order to make certain that tractor motor will be adequate to haul cargo weight at low cost and to prevent damage to motor which might result from overloading and/or breakdown.

Obtains manifest and notes type, kind and size of cargo, method of packing and stops to be made for unloading. Checks and notes type of perishables, degree of temperature required and posts on line haul sheet. Information obtained with respect to type of cargo, how packed, weight, bulk, compactness, fragility, etc. governs speed, method of taking curves, caution to be exercised, etc.

Plans number of hours of driving according to terrain, type of highway, traffic and number of stops to be made for unloading; checks cargo seal to make certain cargo has not been tampered with.

Inspects tires by examining each tire for nicks, cuts, soft spots, peeling tread and other defects; checks air pressure in tires by using air gauge or by kicking tire with foot and noting rigidity of the inflated tire.

Inspects signal lights and emergency four-way flash turning signals by turning on switch; notes proper or improper functioning.

Inspects wheel lugs to determine if wheel is properly centered and secure. Cleans light reflectors and identification plates by wiping off dust and dirt. Inspects "hook-up" to make certain pin is properly positioned and secure.

Inspects air hose and air hose valves to make certain air hose has not been damaged and to ascertain that valves are open.

Makes visual check of springs on tractor and trailer to make certain none are broken. Inspects water level in radiator to make sure it is full; makes cold motor oil check (prior to starting engine) by removing dipstick and noting oil level in motor and replaces stick. Checks air pressure in brake system by turning key to "on" position and noting air pressure on gauge; when air pressure is too low, buzzer sounds informing that brakes will not function. Checks governor on distributor or carburetor to determine if seal is intact. Checks the throw on slack adjustor of brakes for tractor and trailer by applying brake pedal to determine the distance pedal must travel before becoming effective.

Inspects tractor and trailer for damage to cab. Makes sound check of motor by starting, accelerating engine and listening for sounds which might indicate faulty operation or mechanical weakness. Notes oil pressure, air brake pressure, fuel level, etc.

Records all needed repairs and faulty functioning of motor on shop card. Refers card to maintenance supervisor. If safety check is in doubt, refers tractor-trailer for repair. If check revealed need for fuel, water or oil, obtains same at check-out lane.

Makes certain that reactor and trailer identification numbers are attached and properly posted according to I.C.C. Regulations.

Positions trailer into loading dock area by backing tractor and trailer as required.

Supervises and plans loading of cargo into trailer; studies manifest to find out type of cargo and when and where cargo is to be unloaded. Determines method of stacking and packing cargo in accordance with sound freight handling procedures, i.e., heavy equipment and merchandise on bottom and lighter material on top, positioning freight so that it will not shift. Ties down and secures cargo with ropes, chains or blocks as required.

Under simulated conditions, keeps careful check on temperature of refrigerated trailer in order to detect failure of refrigerating unit quickly in order to prevent loss of product.

In accordance with driving plan, keeps careful check of oil, temperature, air dials and simultaneously listens to engine sound in order to detect faulty performance or mechanical failures.

Positions tractor-trailer in unloading area. Obtains receipt for cargo delivered.

Records day's run in log record and hours worked on payroll record.

(This sheet is printed in duplicate. One copy should remain as part of the Appendix in order to complete the technical report. The other copy can be removed by employment service personnel who wish to set up separate fact sheet files.)

* U.S. GOVERNMENT PRINTING OFFICE : 1966 O—225-360