

**Content Validation Report
for
2006 Entry-Level
Firefighter Test**

**Test Preparation Manual (TPM)
9th Ed. Reading Ability Test
and
Writing Ability Test (WAT)**

**Prepared by Fire & Police Selection, Inc.
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Note: The numbers and headings of this report follow the format outlined in Section 15C of the *Uniform Guidelines on Employee Selection Procedures* (1978) for content validity studies.

1. USERS, LOCATION, AND DATES OF STUDY

This validation study was conducted in a conference room at the Tualatin Valley Fire & Rescue training facility in Aloha, Oregon by Fire & Police Selection, Inc. (hereinafter referred to as “FPSI”). The Department is located at 20665 SW Blanton Street, Aloha, OR 97007. The validation study began in September 2005 and was completed in January of 2006.

2. PROBLEM AND SETTING

The purpose of the study was to link the entry-level firefighter position at the Tualatin Valley Fire & Rescue Department to the 2006 Fire & Police Selection, Inc.’s Entry-Level Firefighter Test Preparation Manual (9th Ed.) and Reading Ability Test (hereinafter referred to as the “TPM Test”) and the Writing Ability Test (hereinafter referred to as the “WAT”).

A total of eight (8) subject-matter experts were selected to participate in the validation study. The subject-matter experts represented a diverse pool that had knowledge of the Tualatin Valley Fire & Rescue Department firefighter job and training academy.

See Appendix A for a list of the subject-matter experts who participated in the study.

3. JOB ANALYSIS: CONTENT OF THE JOB

The job analysis method used was called GOJA™ (Guidelines Oriented Job Analysis). The partial firefighter job description (developed by FPSI from work with numerous fire departments) was submitted to the subject-matter experts for their independent review.

A partial job analysis of the Entry-Level Firefighter classification was conducted using eight subject-matter experts on January 12th from 8:00 a.m. to 5:00 p.m. Subject-matter experts reviewed a list of 31 job duties related to reading and writing ability. See Appendix B for a description of these duties.

Subject-matter experts were asked to review 22 duties which were linked to the previous edition of the TPM Test. See Appendix C, “TPM Duty Descriptions and Rating Scales,” for a description of these job duties.

The work behaviors and their associated tasks (called duties) were grouped into common domains. The duty domains identified were: Station Duties; Readiness Training; Inspections; Driving and Positioning Apparatus; Deploying Hose and Pumping; Extinguishing Fire; Probationary Period; and Special Assignments.

For each duty, subject-matter experts identified:

- A) The FREQUENCY the duty was performed (listed as several times a day, daily to weekly, monthly to quarterly, quarterly to yearly, less than yearly, and not performed). Subject-matter experts identified one of the above selections.
- B) The IMPORTANCE level of the duty. A scale of 1 - 5 (1 = not required / 5 = extremely critical) was used.
- C) Whether the duty was PERFORMANCE DIFFERENTIATING (i.e., whether or not performance of the duty makes a difference in the overall job performance). A scale of 1 - 4 (1 = little or no difference / 4 = a very significance difference) was used.

Since the TPM primarily measures one ability, subject-matter experts were asked to assign ratings to the following ability:

“The ability to read, retain, recall and appropriately interpret technical documents in English, including diagrams, fire fighting manuals, general orders, maps and mapped information (such as street maps and/or topography maps) and/or standard operating procedures (SOPs).

For this ability, subject-matter experts identified:

- A) The FREQUENCY the ability was performed (listed as several times a day, daily to weekly, monthly to quarterly, quarterly to yearly, less than yearly, and not performed). Subject-matter experts identified one of the above selections.
- B) The IMPORTANCE level of the ability. A scale of 1 - 5 (1 = not required / 5 = extremely critical) was used.
- C) WHEN the ability was needed on the job. A scale of 1 - 3 (1= fully developed on the job / 3 = fully required at entry) was used.

Additionally, subject-matter experts were asked to link this ability to each of the 22 duties found in the TPM Duty Descriptions. Subject-matter experts identified how important reading ability is to each of the 22 duties. A scale of 1 – 5 (1 = not important / 5 = critically important) was used.

See the introduction to the TPM Job Analysis Rating Survey in Appendix D for actual scales.

Additionally, subject-matter experts were asked to review nine (9) duties anticipated to link to the WAT, described in the “WAT Duty Descriptions and Rating Scales” found in Appendix E.

For each duty, subject-matter experts identified:

- A) The FREQUENCY the duty was performed (listed as several times a day, daily to weekly, monthly to quarterly, quarterly to yearly, less than yearly, and not performed). Subject-matter experts identified one of the above selections.
- B) The IMPORTANCE level of the duty. A scale of 1 - 5 (1 = not required / 5 = extremely critical) was used.
- C) Whether the duty was PERFORMANCE DIFFERENTIATING (i.e., whether or not performance of the duty makes a difference in the overall job performance). A scale of 1 - 4 (1 = little or no difference / 4 = a very significance difference) was used.

Since the WAT measures only one ability, subject-matter experts were asked to assign ratings to the following ability:

“The ability to write legibly in English sufficient to complete forms and standard reports, following department procedures (maintenance and repair reports, permits, records) and to construct easily understood narratives (inspection notices, supplemental fire reports, evidence reports) and to relay messages.”

For this ability, subject-matter experts identified:

- A) The FREQUENCY the ability was performed (listed as several times a day, daily to weekly, monthly to quarterly, quarterly to yearly, less than yearly, and not performed). Subject-matter experts identified one of the above selections.
- B) The IMPORTANCE level of the ability. A scale of 1 - 5 (1 = not required / 5 = extremely critical) was used.
- C) WHEN the ability was needed on the job. A scale of 1 - 3 (1 = fully developed on the job / 3 = fully required at entry) was used.

Additionally, subject-matter experts were asked to link this ability to each of the nine duties found in the WAT Duty Descriptions. Subject-matter experts identified how important writing ability is to each of the nine duties. A scale of 1 - 5 (1 = not important / 5 = critically important) was used.

See the introduction to the WAT Job Analysis Ratings Survey in Appendix F for actual scales.

4. SELECTION PROCEDURE AND ITS CONTENT

TEST PREPARATION MANUAL (TPM) and TEST

The Test Preparation Manual (TPM) approach uses concrete measurement (testing) of a candidate's reading, comprehension, retention, and recall ability which is used as a necessary prerequisite to critical, observable work behaviors and/or products. This is accomplished by providing all candidates with a representative work sample of information in booklet form (TPM) taken directly from critical materials required and used by incumbents on the job. The testing structure of allowing candidates to study and prepare themselves for the test has several benefits:

- A) It replicates and simulates the process applied on the job of learning information and being tested on that information;
- B) It measures (in a fair, job-related format) a candidate's ability to read, comprehend, retain, and recall technical, job-related information;
- C) It allows for educationally disadvantaged candidates to compensate for lack of academic skills by extra study, as they would be able to on the job; and
- D) It allows candidates exposure to the type of reading materials they will be learning on the job.

TEST PREPARATION MANUAL (TPM)

The Test Preparation Manual (TPM) was originally written in 1984 under the direction of Biddle & Associates by qualified subject-matter experts working in fire departments similar to that of the Tualatin Valley Fire & Rescue Department. Information in the TPM represented a carefully selected sample of job and academy materials frequently used by firefighters on the job. In order to sample a broad range of reading material types (different sentence structures, contexts, and formats) read by firefighters officers on the job and in the academy, 115 pages in six chapters were included in the TPM representing various types of reading samples read on the job and in the academy. The six chapters in the TPM were:

- 1) Fire Chemistry
- 2) Hoses and ladders
- 3) Tools and Equipment
- 4) Ventilation/Overhaul/Salvage

- 5) Fire Aid and Rescue
- 6) Fire Prevention

The TPM was updated in Long Beach in 1996, where the seventh chapter was added to the manual. The information included within the new chapter was selected by qualified subject-matter experts in Long Beach, California. The chapter was entitled “General Fire Ground Operations” and extended the TPM to 134 pages in seven (7) chapters.

Since the update in 1996, the TPM (7th Ed.) has been used as a screening device by hundreds of fire departments. Given this exposure to this edition, FPSI was asked by the Las Vegas and North Las Vegas Fire Department to create a new TPM edition (8th Ed.). The TPM (8th Ed.) contains some content from previous editions as well as new content. FPSI obtained input from the fire department personnel to determine desirable content areas for the edition. Dozens of fire departments expressed a need for a chapter on Emergency Medical Technician (EMT) content as well as Standard Operating Procedures (SOPs). Given the timing of the edition and the world events following September 11th 2001, many felt that a chapter on Homeland Security was appropriate.

The TPM (8th Ed.) consists of five fire-related chapters. The material is presented in a format similar to how it is presented in the fire academy and on-the-job. The five chapters in the TPM (8th Ed.) are:

- 1) Fire Chemistry
- 2) Tools and Equipment
- 3) Homeland Security
- 4) Emergency Medical Technician (EMT)
- 5) Standard Operating Procedures (SOPs)

Since the 2003 development of the TPM (8th Ed.), thousands of firefighter candidates have been exposed to the content and the related test forms. In 2005, FPSI was contacted by the Tualatin Valley Fire & Rescue Department and asked to create an updated version of the TPM for its upcoming entry-level firefighter recruitment. The new TPM (9th Ed.) was created to ensure that a fresh manual is available for agencies interested in measuring reading ability while ensuring the integrity of an undated TPM and test forms.

FPSI included a new chapter, Firefighter Orientation, to provide an overview of the fire service industry. Additionally, the EMT chapter was replaced with the First Aid and Rescue chapter and the SOP chapter was updated with new content received from the Tualatin Valley Fire & Rescue Department.

The new TPM (9th Ed.) consists of 96 pages of five fire-related chapters. The chapters in the TPM (9th Ed.) are:

- 1) Firefighter Orientation
- 2) Tools and Equipment
- 3) Homeland Security
- 4) First Aid and Rescue
- 5) Standard Operating Procedures (SOPs)

The candidates are given between three and five weeks to study the TPM prior to taking the exam. Firefighters are typically required to read, study, and learn over 2000 pages of reading material during the first year on the job, and over 3000 pages in approximately 6-12 weeks of the academy.

The TPM has been carefully designed in light of the Uniform Guidelines on Employee Selection Procedures (1978). The TPM is designed to REPLICATE THE TYPE of materials that firefighters read on the job and to SIMULATE THE PROCESS used to read, comprehend, retain, and recall firefighter job and academy reading materials.

Surveys were given to the Tualatin Valley Fire & Rescue Department subject-matter experts to gather evidence to support that the TPM Test measures the reading ability required for successful job performance and that it is a representative sample of the reading materials that are read on the job and academy (see Section 5 below).

See Appendix G for a copy of the TPM (9th Ed.).

TPM TEST

The TPM Test includes multiple-choice written test items constructed from the material in the TPM. The questions are designed to measure each candidate's mastery of the body of information contained in the TPM. All the answers to the items on the test are in the TPM.

The TPM Test pool contains 207 items and is currently split into two equal test forms with only three overlapping items--each containing 80 items. Each item has four alternatives: one key and three distractors. The remaining 50 items were used to create a practice test which may be used by candidates to evaluate their understanding of the TPM prior to taking the test.

The subject-matter expert item review included the following:

- A) Reviewing the item distractors for incorrectness,
- B) Reviewing the correctness of the key,
- C) Reviewing page reference in the TPM,
- D) Ensuring the uniqueness of each test item (duplicates, similar items, items which provided or pointed to key of the other items), and

- E) Identifying the Minimum Expected Passing (Angoff rating--see Sections 5 and 7 below for further description).

Items that did not meet the above criteria were either deleted or revised in order to meet the criteria. Items that were revised were re-rated in the workshop.

The behaviors and abilities measured by the TPM and Test were identified and confirmed by subject-matter experts in an earlier study on the Job Description and other test validation forms discussed throughout this report (see Section 5 below).

The Tualatin Valley Fire & Rescue Department subject-matter experts identified and confirmed that the TPM (9th Ed.) Test measures and is a representative sample of the reading ability required for successful job performance. The reading ability identified by subject-matter experts is defined below:

“The ability to read, retain, recall and appropriately interpret technical documents in English, including diagrams, fire fighting manuals, general orders, maps and mapped information (such as street maps and/or topography maps) and/or standard operating procedures (SOPs).”

The above definition was taken from item O16 on the original Job Description. See Appendix H for a copy of the original job description.

Tualatin Valley Fire & Rescue Department subject-matter experts identified the reading ability required on the job as:

- A) FREQUENTLY performed DAILY or SEVERAL TIMES A DAY - (subject-matter experts assigned it a rating of 5 or 6 on a scale of one through six), and
- B) CRITICAL or EXTREMELY CRITICAL - Necessary for the performance of the job (subject-matter experts assigned it an importance level of 4 or 5 on a scale of one through five), and
- C) GENERALLY REQUIRED or FULLY REQUIRED AT ENTRY - (subject-matter experts assigned it a rating of 2 or 3 on a scale of one through three).

Subject-matter experts identified reading ability as:

CRITICAL – Necessary for the performance of the job. (Subject-matter experts assigned this ability an importance level of 4.38 on a scale of one to five).

Tualatin Valley Fire & Rescue Department subject-matter experts identified reading ability required on the job as:

- A) FREQUENTLY performed SEVERAL TIMES A DAY - (100% of the subject-matter experts assigned it a rating 6 on a scale of 1-6; $M = 6.00$), and
- B) CRITICAL or EXTREMELY CRITICAL - Necessary for the performance of the job (100% of the subject-matter experts assigned it an importance level of 4 or 5 on a scale of 1-5; $M = 4.38$), and
- C) GENERALLY REQUIRED or FULLY REQUIRED AT ENTRY - (100% of the subject-matter experts assigned it a rating of 3 on a scale of 1-3; $M = 3.00$).

WAT TEST

The WAT Test questions are designed to measure the candidates' mastery of the English language relating to basic writing concepts. The WAT Test pool contains 103 items and can be split into two equal test forms, with no duplicate items--each containing 40 items for agencies interested in a short-form version of the WAT. Each item has four alternatives: one key and three distractors. The remaining 23 items were used to create a practice test which may be used by candidates to evaluate their writing ability prior to taking the test.

The subject-matter expert item review occurred on January 13th from 8:00 a.m. to 1:00 p.m. and included the following:

- A) Reviewing the item distractors for incorrectness,
- B) Reviewing the correctness of the key,
- C) Ensuring the uniqueness of each test item (duplicates, similar items, items which provided or pointed to key of the other items), and
- D) Identifying the Minimum Expected Passing (Angoff rating--see Sections 5 and 7 below for further description).

Items that did not meet the above criteria were either deleted or revised in order to meet the criteria. Items that were revised were re-rated in the workshop.

The behaviors and abilities measured by the WAT were identified and confirmed by subject-matter experts in an earlier study on the Job Description and other test validation forms discussed throughout this report (see Section 5).

The Tualatin Valley Fire & Rescue Department subject-matter experts identified and confirmed that the WAT measures and is a representative sample of the writing ability required for successful job performance. The writing ability identified by subject-matter experts is defined below:

“The ability to write legibly in English sufficient to complete forms and standard reports, following department procedures (maintenance and repair reports, permits, records) and to construct easily understood narratives (inspection notices, supplemental fire reports, evidence reports) and to relay messages.”

The above definition was taken from item O18 on the original Job Description. See Appendix H for a copy of the original job description. Subject-matter experts identified writing ability as:

EXTREMELY CRITICAL – Necessary for the performance of the job with more extreme consequences. (Subject-matter experts assigned this ability an importance level of 4.75 on a scale of 1-5).

Tualatin Valley Fire & Rescue Department subject-matter experts identified writing ability required on the job as:

- A) **FREQUENTLY performed SEVERAL TIMES A DAY** - (100% of the subject-matter experts assigned it a rating of 6 on a scale of 1-6; $M = 6.00$), and
- B) **CRITICAL or EXTREMELY CRITICAL** - Necessary for the performance of the job (100% of the subject-matter experts assigned it an importance level of 4 or 5 on a scale of 1-5; $M = 4.75$), and
- C) **GENERALLY REQUIRED or FULLY REQUIRED AT ENTRY** - (100% of the subject-matter experts assigned it a rating of 2 or 3 on a scale of 1-3; $M = 2.88$).

5. RELATIONSHIP BETWEEN THE SELECTION PROCEDURE AND THE JOB

Each component of previous editions of the TPM and TPM Test have been evaluated for content validity in earlier studies. For purposes of the Tualatin Valley Fire & Rescue Department, subject-matter experts reviewed the entire content of the TPM (9th Ed.) and linked the process of the TPM (9th Ed.) to the position of entry-level firefighter at the Tualatin Valley Fire & Rescue Department.

TPM Test

Subject-matter experts linked reading ability to several job duties. Reading ability was determined to be of **major importance** or **critically important** (rating of 4 or 5 on the Duty/Ability Linkage Ratings in Appendix D) for the following **critical** or **extremely critical** (rating of 4 or 5 on the Importance Ratings in Appendix C) duties which makes a **significant** or **very significant** difference in overall job performance (a rating of 3 or 4 on the Performance Differentiating Ratings in Appendix C):

- Duty 2: *Develops and maintains a good working knowledge of department policy and procedure manuals.*
- Importance = 3.88 Performance Differentiating = 3.50
Duty/Ability Linkage = 5.00
- Duty 3: *Encourages reading and studying of fire fighting training materials such as general orders SOPs, SOGs, and policies and procedures.*
- Importance = 4.13 Performance Differentiating = 3.50
Duty/Ability Linkage = 4.75
- Duty 4: *Maintains working knowledge of buildings and roads.*
- Importance = 3.63 Performance Differentiating = 3.13
Duty/Ability Linkage = 4.00
- Duty 5: *Receives and reads study materials as assigned.*
- Importance = 4.00 Performance Differentiating = 3.38
Duty/Ability Linkage = 4.63
- Duty 8: *Takes inventory and records and reports equipment and apparatus missing or needing repair or replacement.*
- Importance = 4.13 Performance Differentiating = 3.00
Duty/Ability Linkage = 4.00
- Duty 9: *Answers business phones and receives walk-in fire calls. Reads and works with grid, maps to locate calls. Reads and works with grid map book to respond to calls.*
- Importance = 4.50 Performance Differentiating = 3.50
Duty/Ability Linkage = 4.38
- Duty 12: *Maintains EMS (Emergency Medical Services) re-certifications: CPR (Cardio-Pulmonary Resuscitation) and EMT (Emergency Medical Technician).*
- Importance = 4.63 Performance Differentiating = 3.50
Duty/Ability Linkage = 4.50
- Duty 14: *Provides EMS to level of certification including assessment, treatment, and documentation to victims at emergency scene or while en route to the hospital.*

- Importance = 5.00 Performance Differentiating = 4.00
Duty/Ability Linkage = 4.75
- Duty 17: *Assists paramedics with patient care (within scope of EMS/EMT training).*
- Importance = 4.50 Performance Differentiating = 3.88
Duty/Ability Linkage = 4.38
- Duty 18: *Tracks and restocks supplies used on emergency calls and ensures that the ambulance is ready for use.*
- Importance = 4.50 Performance Differentiating = 3.50
Duty/Ability Linkage = 4.25
- Duty 19: *Receives specific training due to probationary status.*
- Importance = 4.38 Performance Differentiating = 3.38
Duty/Ability Linkage = 4.38
- Duty 23: *Writes report(s) to describe in a clear, accurate, and concise manner, all primary and relevant activity and developments. May include diagrams or sketches.*
- Importance = 4.38 Performance Differentiating = 3.50
Duty/Ability Linkage = 4.75
- Duty 26: *Writes brief reports to document an event.*
- Importance = 4.00 Performance Differentiating = 3.13
Duty/Ability Linkage = 4.75
- Duty 27: *Writes descriptive reports consisting of short sentences and/or phrases (e.g., incident reports, etc.)*
- Importance = 4.13 Performance Differentiating = 3.25
Duty/Ability Linkage = 4.63
- Duty 28: *Writes in-depth narrative reports containing complete sentences and paragraphs.*
- Importance = 4.13 Performance Differentiating = 3.25
Duty/Ability Linkage = 4.88

Duty 29: *Writes reports to be complete and understandable.*
Importance = 4.25 Performance Differentiating = 3.25
Duty/Ability Linkage = 4.88

Duty 30: *Completes all necessary departmental forms.*
Importance = 4.13 Performance Differentiating = 3.13
Duty/Ability Linkage = 4.50

WAT Test

Subject-matter experts linked writing ability to several job duties. Writing ability was determined to be of **major importance** or **critically important** (rating of 4 or 5 on the Duty/Ability Linkage Ratings in Appendix F) for the following **critical** or **extremely critical** (rating of 4 or 5 on the Importance Ratings in Appendix E) duties which makes a **significant** or **very significant** difference in overall job performance (a rating of 3 or 4 on the Performance Differentiating Ratings in Appendix E):

Duty 23: *Writes report(s) to describe in a clear, accurate, and concise manner, all primary and relevant activity and developments. May include diagrams or sketches.*

Importance = 4.38 Performance Differentiating = 3.50
Duty/Ability Linkage = 4.75

Duty 26: *Writes brief reports to document an event.*

Importance = 4.00 Performance Differentiating = 3.13
Duty/Ability Linkage = 4.75

Duty 27: *Writes descriptive reports consisting of short sentences and/or phrases (e.g., incident reports, etc.)*

Importance = 4.13 Performance Differentiating = 3.25
Duty/Ability Linkage = 4.63

Duty 28: *Writes in-depth narrative reports containing complete sentences and paragraphs.*

Importance = 4.13 Performance Differentiating = 3.25
Duty/Ability Linkage = 4.88

Duty 29: *Writes reports to be complete and understandable.*

Importance = 4.25 Performance Differentiating = 3.25
Duty/Ability Linkage = 4.88

Duty 30: *Completes all necessary departmental forms.*

Importance = 4.13 Performance Differentiating = 3.13
Duty/Ability Linkage = 4.50

TPM AND READING ABILITY COMPONENT

Eight (8) subject-matter experts compared the reading ability and process of reading required on the job and academy to that of the TPM. This was done in order to evaluate if the content and use of the TPM were similar and related to the content of the reading material used on the job and academy. The subject-matter experts completed a Firefighter TPM Validation Survey from which these conclusions on job relatedness were made.

The following are summaries, averages, and conclusions from the survey:

- A) Subject-matter experts' average opinion was that 2.93 hours of reading was spent each "on" day in the academy.
- B) Subject-matter experts' average opinion was that 3.63 hours of reading was spent each "off" day in the academy.
- C) All 8 subject-matter experts (100%) stated that they could not have passed the academy without the ability to read, comprehend, retain, and recall written information.
- D) Eight (8) of the subject-matter experts (100%) stated that they could not have adequately performed the duties of a firefighter without the ability to read, comprehend, retain, and recall job-related materials.
- E) Eight (8) of the subject-matter experts (100%) stated that they could not have passed the academy **solely** through listening to lectures, attending class discussions, and/or other learning experiences WITHOUT independently reading and studying assigned materials.
- F) Eight (8) of the subject-matter experts (100%) stated that they could not learn the necessary information to adequately perform the duties of a firefighter **solely** through listening to lectures, attending training sessions, and/or other learning experiences WITHOUT independently reading and studying job-related materials.

- G) Eight (8) of the subject-matter experts (100%) stated that the TPM did, as a whole, REPRESENTATIVELY SAMPLE the different types of materials that must be read on the job.
- H) Eight (8) of the subject-matter experts (100%) stated that the TPM did, as a whole, REPRESENTATIVELY SAMPLE the different types of materials that must be read in the academy.
- I) Eight (8) of the subject-matter experts (100%) stated that the FORMAT (the general make-up and structure) of the materials in the TPM was similar to most of the required reading materials on the job.
- J) Eight (8) of the subject-matter experts (100%) stated that the FORMAT (the general make-up and structure) of the materials in the TPM was similar to most of the required reading materials in the academy.
- K) Eight (8) of the subject-matter experts (100%) stated that the CONTEXT (sentence structure) of the materials in the TPM was similar to most of the required reading materials on the job.
- L) Eight (8) subject-matter experts (100%) stated that the CONTEXT (sentence structure) of the materials in the TPM was similar to most of the required reading materials in the academy.
- M) Eight (8) of the subject-matter experts (100%) stated that the process of having the candidate read the materials in the TPM REPLICATES (duplicates or repeats) some of the required reading part of the job and the academy.

See Appendix I for a copy of the “Firefighter TPM Validation Survey.”

READABILITY ANALYSES

As different readability analyses tend to produce different results, FPSI evaluated materials found in other fire departments and previous editions of the TPM with four readability techniques: (1) the Flesch-Kincaid, (2) the Coleman-Liau, (3) the Bormuth, and (4) the FOG Readability Index. Each of these analyses evaluated a number of passages from both sets of the documents and produced a readability statistic expressed in a grade level. For example, a readability statistic of 11.0 indicates an 11th grade reading level. The average reading level, associated with the typical materials found in other fire departments, was 12.2; the average reading level of the TPM (9th Ed.) is 10.4. Therefore, the reading level of the TPM is slightly below, but well within the range, of the level required for the job.

EFFORTS TO REDUCE ADVERSE IMPACT

The TPM is based on a concept designed to minimize adverse impact. Candidates who have "educational disadvantages" may compensate through extra study for FPSI's TPM Test.

Throughout over 20 years of protective service testing, Biddle & Associates and FPSI have continually evaluated and compared passing rates for the TPM Test against other protective service written tests (with and without pre-test study guides). The TPM Test consistently has demonstrated less adverse impact than the other tests to which it has been compared.

Several public employers across the nation have used the TPM concept to reduce adverse impact, and it is a nationally recognized method among test publishers for reducing adverse impact.

See Appendix J for a paper presented at the 1992 International Personnel Management Association Assessment Council Conference regarding the success of one city in reducing adverse impact by using a TPM style test.

OTHER VALIDITY EVIDENCE

Biddle & Associate's TPM Test has been validated in numerous police and fire departments across the nation. In 1982, the firefighter Test was challenged and upheld for the first time in Federal Court where content validity was the major defense although criterion-related validity was also presented for a small sample (see Appendix K for the court decision and criterion-related validity documents used in court). In 1996 the firefighter TPM and Test was challenged again and upheld for a second time in Federal Court where content validity was the major defense. The TPM Test was found to be job-related and consistent with business necessity (see Appendix L for the court decision). Both content validity and criterion-related validity studies have been conducted for the firefighter TPM Test.

6. ALTERNATE PROCEDURES INVESTIGATED

Clients from earlier validation studies involving fire departments considered the TPM test and two other tests, one developed by Stanard & Associates and the other by Donnoe & Associates. The clients evaluated the adverse impact data from its prior administration of the Biddle & Associates' Entry-Level Fire Test and the available information from the two other testing agencies. Based on this data and on discussions with test administrators from other cities, the TPM Test was felt to have the highest likelihood of maintaining validity with the least amount of adverse impact from the alternatives available at the time.

7. USES AND APPLICATIONS

The TPM (9th Ed.) Test and the WAT are recommended to be used as selection tools for hiring entry-level firefighters. It has been a policy of FPSI to recommend that the TPM Test and the WAT be used on a pass/fail basis in order to minimize adverse impact. However, data to support the use of ranking was gathered by the Tualatin Valley Fire & Rescue Department subject-matter experts and the TPM Test and the WAT can be used as a ranked or banded selection device. See the end of Section 7 for the data gathered to support ranking/banding.

METHOD OF CUTOFF DETERMINATION

To estimate a minimum cutoff level for the TPM Test and the WAT, FPSI used the Modified Angoff Technique. See Appendix M for an in-depth description of the Modified Angoff Technique. This method has been supported in Bouman v Block post judgment enforcement litigation and numerous related EEO/testing cases. Subject-matter experts from the Tualatin Valley Fire & Rescue Department used Cutoff Data Entry Forms to confirm the test key, confirm the page reference in the TPM, and to give their opinions on "the percentage of minimally-qualified candidates who were likely to answer this item correctly" for each item on the test. All of this information was thoroughly described orally to these subject-matter experts and given to them in writing. A "minimally-qualified candidate" was defined as: "one who possesses a competent level of the ability being measured to successfully perform the job." The concept of a "minimally-qualified candidate" was discussed at length with the subject-matter experts. Examples of minimally-qualified, below minimally-qualified, and above minimally-qualified candidates were discussed openly with the group until a consensus opinion of a minimally-qualified candidate was reached.

After the workshop, the survey results were tabulated and summarized. The mean average of the subject-matter experts' opinions on the percent of "minimum-qualified candidates expected passing" for the 80-items in the TPM Test Form 9A was 86.53%, or 69 of the 80 items answered correctly. The mean average of subject-matter experts' opinions on the percent of "minimum-qualified candidates expected passing" for the 80-items in the TPM Test Form 9B was 86.49%, or 69 of the 80 items answered correctly. The mean average of subject-matter experts' opinions on the percent of "minimum-qualified candidates expected passing" for the 80-items in the WAT was 84.56%, or 68 of the 80 items answered correctly.

To properly consider several human and statistical factors, the Angoff average for Form 9A (86.53%) should be reduced by at least one (1) conditional standard error of measurement (CSEM). To calculate the CSEM, the difference scores between the candidates' responses to the odd and even test questions should be calculated. Once the absolute difference is obtained, the next step is to capture the difference values of candidates who fall two points above the critical score (Angoff), the critical score, and two points below the critical score (five points). If this procedure includes at least 30 people, use only those scores in the calculation of the CSEM. If not, begin widening the range of scores included by going three points up and three points down, four points up

and four points down, etc., until at least 30 people have been reached. The CSEM is determined by calculating the standard deviation of the selected scores around the critical score. Additionally, this same process would be used for determining a cutoff score for the TPM Test Form 9B and the WAT.

An example comes from an earlier administration of the Firefighter TPM Test Form 7A. The Angoff of Form 7A is 96 (76.32% of the items answered correctly). By calculating the standard deviation of the difference scores around the critical score, one CSEM was determined to be 3.58. This means that by reducing the Angoff by one, two, or three CSEMs, possible cutoffs for this test administration are 92, 89, and 85, respectively.

For administrations with less than 50 candidates, FPSI recommends that the SEM be used to identify an appropriate cutoff score. To calculate the SEM of the test, the reliability and standard deviation of the test is needed. The formula for calculating the SEM is: the standard deviation of the test times the square root of one (1) minus the test reliability (see formula below).

$$\text{Standard Error of Measurement:} \quad \mathbf{SD} \sqrt{1 - r_{tt}}$$

For example, if the standard deviation of the test was 15.0 and the reliability was .90 (typical statistics based upon other administration), a standard error of measurement of 4.74 would be derived. Using the SEM of 4.74, a cutoff using one SEM below the Angoff mean would be a score of 91.

Following the decision in United States v. South Carolina (434 US 1026, 1978), at least four statistical and human factors should be considered when determining whether to lower the Angoff mean by one (1), two (2), or three (3) CSEMs or SEMs.

The factors are:

- A) The possibility of sampling error in the study,
- B) The consistency of the results (internal comparisons of panel results),
- C) The supply of and demand for the position being tested, and
- D) The racial composition of the job classification.

At least one (1) CSEM or SEM should be used. After the application of the adjustment defined above, the resulting score is one that reflects the minimum competency level of the test.

It is the policy of FPSI to recommend a cutoff that minimizes adverse impact set at or above the minimum competency level of the test. FPSI recommends using both statistical significance and practical significance tests when analyzing tests for adverse impact.

FPSI recommends allowing candidates two hours for the TPM Test and two hours for the WAT Test. A widely accepted practice used to determine time limits for written tests is to allow candidates one minute per question plus one-half an hour to the overall test. Therefore, if a test has 90 items, an appropriate time limit would be two hours (e.g., 90 items x 1 minute = 90 minutes plus 30 minutes = 2 hours). For candidates with qualified disabilities, FPSI recommends doubling the normal time allowed.

RANKING AND SCORES ABOVE MINIMUM COMPETENCY

Evidence to support the use of ranking, banding, or using scores that are higher than the Angoff level (see above) was obtained in this validation study. Subject-matter experts identified reading ability, as defined in O16 (see Appendix H) as *performance differentiating*. Additionally, subject-matter experts identified writing ability, as defined in O18 (see Appendix H) as *performance differentiating*. Of the twenty TPM duties linked to reading ability as defined in the Job Description, seventeen (85%) were said to be critical and performance differentiating. Of the eight WAT duties linked to writing ability as defined in the Job Description, six (75%) were said to be critical and performance differentiating.

Listed below are performance differentiating ratings for all duties linked to the TPM Test and the WAT (see Appendices B and D, respectively, for duty descriptions).

TPM Duty Ratings

TPM Duty Number	Performance Differentiating Rating
2	3.50
3	3.50
4	3.13
5	3.38
8	3.00
9	3.50
12	3.50
14	4.00
17	3.88
18	3.50
19	3.38
23	3.50
26	3.13
27	3.25
28	3.25
29	3.25
30	3.13

WAT Duty Ratings

WAT Duty Number	Performance Differentiating Rating
23	3.50
26	3.13
27	3.25
28	3.25
29	3.25
30	3.13

The *Uniform Guidelines on Employee Selection Procedures* (1978) stated the following regarding the use of ranking on employment-related tests:

“Ranking based on content validity studies. If a user can show, by job analysis or otherwise, that a higher score on a content valid selection procedure is likely to result in better job performance, the results may be used to rank persons who score above minimum levels. Where a selection procedure supported solely or primarily by content validity is used to rank job candidates, the selection procedure should measure those aspects of performance which differentiate among levels of job performance.” (EEOC, CSS, DOL, & DOJ, 1978, § 14C-9)

The *Guidelines* also stated the following regarding ranking and cutoff scores:

“Where applicants are ranked on the basis of properly validated selection procedures and those applicants scoring below a higher cutoff score than appropriate in light of such expectations have little or no chance of being selected for employment, the higher cutoff score may be appropriate, but the degree of adverse impact should be considered.” (EEOC ET AL., 1978, § 5H)

The evidence obtained from the Tualatin Valley Fire & Rescue Department subject-matter experts provided support for ranking, banding, and/or cutoff scores, above minimum competency levels by means of the Job Analysis.

Based upon past test administration of previous TPM editions, the reliability of the TPM Test is consistently high (between .90 and .94) and the standard deviation of the Test is consistently between 9.0 and 14.0, which shows an adequate discrimination in the score distribution. Therefore, it is appropriate under content validity to rank-order or band scores above the minimum competency score and/or to select cutoff scores above the minimum competency score.

If ranking is used for the TPM Test and the WAT, FPSI recommends creating bands (rather than top-down ranking) using the standard error of difference (SED) measurement. The SED is the standard deviation of the test multiplied by the square root of 1 minus the reliability coefficient of the test multiplied by the square root of two (2).

The data described in this section lends support for setting cutoff scores higher than the minimum competency level (see the three references above showing that cutoffs may be set higher than normal expectations of minimum competency if the data supporting the test shows it is differentiating or there are so many candidates that a lower score is not reasonable).

When the TPM Test and the WAT are used in conjunction with one another, it is recommended that the candidate pass both tests, independently of one another, at the identified cutoff score. In other words, the test results should be used in a multiple-hurdle approach as opposed to a compensatory approach in order to ensure that candidates possess the minimum competencies levels in these areas irrespective of their overall or combined test score.

8. CONTACT PERSON

The consulting agency that performed the work is:

Fire & Police Selection, Inc.
193 Blue Ravine Rd., Ste. 270
Folsom, CA 95630
916.294.4242

The assigned consultants were Stacy L. Bell (Director/Principal Consultant) and Dan Biddle, Ph.D. (President) of Fire & Police Selection, Inc.

9. ACCURACY AND COMPLETENESS

The subject-matter experts who attended the validation workshop independently assessed the transportability of the Job Description to the 2006 Tualatin Valley Fire & Rescue firefighter classification. When the data was tabulated by FPSI staff, the data tabulation performed by one person was checked by another person.