

SECTION C
JOB DATA ANALYSIS
TO DEFINE PHYSICAL PERFORMANCE DEMANDS

The data for this project were obtained from several sources in an attempt to define systematically the physical demands and tasks of 19 agency officers. Thomas and Means assumed that the physical demands of the job are those factors that should define fitness standards. Sequentially, Thomas and Means collected and reviewed the following sources of job information: 1) existing job descriptions and agency job task analyses, 2) use of force critical incidents, 3) injury/absenteeism data and 4) this study's focused job-task analysis.

First we needed to define the frequent and critical physical tasks performed by incumbents, the conditions under which they are performed, and the underlying physical fitness variables that influence job performance. Secondly we needed to narrow the taxonomy of tasks and underlying physical fitness variables to the most important physical task performance and fitness performance areas to measure, as well as define the job-task tests and fitness tests that can measure an individual's performance capabilities.

There are two major sub-sections to this section: A) Job-Task Data Definition and B) Fitness and Job-Task Test Definition.

A. JOB-TASK DATA DEFINITION

There were several sources of information that provided data and or input to aid in defining the physical demands of the job of police officer for the 19 agencies. First, Fitness Thomas and Means (FIT) reviewed current job descriptions and any job task analyses (JTA) from the 19 police departments to identify currently defined physical performance demands. Secondly, FIT reviewed use of force critical incident reports to determine if there were any significant trends suggesting the importance of any underlying physical abilities or factors. Thirdly, injury/absenteeism data were reviewed to ascertain the extent that on-the-job injuries could be affected by lack of physical fitness or abilities. Finally the focused JTA performed specifically for this study was critically analyzed to define physical demands at the most detailed level of specificity.

EXISTING JOB POSITION DESCRIPTIONS AND JTA DATA

There was considerable variation as to level of specificity between the agencies with only two agencies reporting any job task analysis information. The various duties and work factors which could be influenced by one's physical fitness level (as described in agency job descriptions and JTAs) are presented in Table C1. The wording presenting is identical to the wording in the respective job descriptions.

TABLE C1
 ESSENTIAL PHYSICAL TASKS AND REQUIREMENTS IDENTIFIED BY JOB DESCRIPTIONS
 AND JTA DATA FROM THE 19 AGENCIES

<u>AGENCY</u>	<u>REQUIREMENTS</u>
Brigham City	Make arrests. Work conditions may occasionally require extreme physical effort. Maintain general physical condition and agility.
Cedar City	Maintain Department physical standards for purposes of pursuing, subduing, arresting suspects and defending against physical assaults.

	Run out of vehicles, walking, bending, standing, lifting heavy objects
Centerville	Requires a variety of physical activities involving muscle strain, walking, standing, stooping and lifting.
Escalanti	Apprehend and deliver stray animals to shelter. Have the ability to perform strenuous manual labor and ability to lift 100 lbs.
Kanab City	Participate in high risk, hazardous emergency activities. Perform work requiring good physical condition. Perform a variety of physical activities some involving muscle strain requiring walking, standing, stooping and lifting.
Layton City	Ability to react effectively in emergencies, life and death and stressful situations. Perform work requiring good physical condition. Work in conditions where physical readiness is essential to effective job performance and conditions requiring continuous use of motor skills.
Mapleton	Ability to respond to situations requiring physical endurance and stress. Ability to perform work requiring good physical condition.
Mt. Pleasant	Must be physically fit and able to pursue on foot unlawful suspects.
Ogden City	Maintain physical condition appropriate to assigned duties which may involve the following: <ul style="list-style-type: none"> - affecting an arrest - subduing a resisting individual - pursue a fleeing suspect - run/walk and crawl - move equipment and persons - climb stairs - perform life saving rescue procedures - walk/stand/sit Work in conditions involving people control, intense life threatening situations that involve walking, running crawling, climbing stooping and lifting.
Orem	Maintain physical condition appropriate to assigned duties which may involve the following: <ul style="list-style-type: none"> - affecting an arrest - pursue a fleeing suspect - perform fire suppression and rescue operations - lift, carry and drag heavy objects - climb over and around obstacles

- jump down from elevated surface
- climb through openings
- jump over obstacles
- crawl in confined spaces
- balance on uneven surface

Perform major physical activities occasionally or frequently to include the following:

- physical confrontation that involves wrestling and using force
- restraining hands and controlling individual and crowds
- engage in foot pursuit
- encounter rough terrain
- lift 10-50 lbs.
- lift 50-175 lbs

Plain City	Ability to respond to situations requiring physical endurance and stress.
Riverdale	Ability to react effectively in emergencies, life and death and stressful situations Ability to perform requiring good physical condition.
Roy City	Ability to react effectively in emergencies, life and death and stressful situations. Ability to perform requiring good physical condition. Tasks require a variety of activities requiring muscular strength such as walking, standing, stooping, and reaching.
South Jordan	Ability to perform work requiring good physical condition. Ability to respond to situations requiring physical endurance and stress.
Spanish Fork	Duties include effecting an arrest, forcing and subduing resisting suspects. Performing rescue operations Ability to react effectively in emergency and stressful situations. Ability to perform work requiring good physical condition. Essential functions include <ul style="list-style-type: none"> - frequent walking, standing and sitting - occasional running, jumping, balancing, climbing, crawling, stooping, kneeling, reaching, lifting, carrying, pushing, pulling and throwing - occasionally require extreme muscular exertion and rapid speedwork
Springville	No data
Unitah	No data
West Jordan	Essential functions include the ability to jump, kneel, bend and lift 100 lbs.

West Valley Physical demands require muscular strength in hands arms, legs, back.
Ability to pursue, subdue and apprehend a hostile and combative suspect.
Work environment has moderate to heavy physical activity.

- Essential physical functions include:
- subdue and arrest resisting individuals
 - pursue suspect on foot
 - stand long periods
 - run more than 50 yards
 - run fast for short periods
 - go up and down stairs
 - climb over obstacles such as fences
 - walk long periods of time
 - climb over 6 foot obstacle
 - pull self over obstacle
 - lift and carry injured person
 - lift and carry heavy objects
 - forced entry into buildings
 - jump down from elevated surfaces
 - crawl
 - climb through opening
 - pull self through opening
 - run long periods of time
 - drag person
 - push heavy objects
 - run a mile or greater
 - carry unconscious person

The job description and JTA information, while having differing levels of specificity by agency, clearly indicate that the police officer position in all agencies is a physically demanding position that would require many components of fitness. Of note is the commonality among agencies. Many of the job descriptions used identical wording to describe the police officer position.

USE OF FORCE CRITICAL INCIDENT DATA

Several of the agencies were able to provide use of force critical incident reports spanning a time period of one to three years. These reports were reviewed for 1) the

number of incidents in which strenuous physical effort was required and 2) implications of the underlying fitness or abilities to perform the requirements of that incident. The review conclusions are reported in Table C2.

TABLE C2
CRITICAL INCIDENTS REQUIRING UNDERLYING PHYSICAL FITNESS

<u>AGENCY</u>	<u>REPORTED INCIDENTS</u>	<u>UNDERLYING FITNESS REQUIRED</u>
Brigham City	No data	
Cedar City	No data	
Centerville	9 incidents duration force and strength	3 (33.3%) involved aerobic pursuits over 2 min. 4 (44.4%) involved short term anaerobic use of
Escalanti	no data	
Kanab City	no data	
Layton City	46 incidents	4 (8.6%) involved aerobic pursuits over 2 minute duration 4 (8.6%) involved short term anaerobic use of force and strength
Mapleton	no data	
Mt. Pleasant	no data	
Ogden City	no data	
Orem	no data	
Plain City	no data	
Riverdale	1 incident	1 (100%) involved short term (anaerobic) use of force and strength
Roy City	no data	
South Jordan	22 incidents	7 (31.8%) involved short term (anaerobic) use of force and strength 1 (4.5%) involved aerobic pursuit over 2 minute duration
Springville	no data	

Spanish Fork	no data	
Unitah	no data	
West Jordan	no data	
West Valley	323 incidents	7 (2.2%) involved aerobic pursuits over 2 minutes duration 102 (31.6%) involved short term (anaerobic) use of force and strength
TOTAL	401 incidents	15 (3.7%) involved aerobic pursuits over 2 minutes duration 118(29.4%) involved short term (anaerobic) use of force and strength

Anecdotally, many of the use of force incidents reported involved minor physical activity such as having to use a restraining device on an individual or engaging in a automobile pursuit. The data does suggest that those incidents that did involve strenuous effort appeared to be predominately anaerobic in nature. However, several of the incidents (4) that were aerobic consisted of foot pursuits lasting over 20 minutes. Of note is that none of the incident records reported the use of firearms.

These data must be interpreted with some caution because only a few agencies had use of force incident reporting. In conclusion, the use of force critical incident data that was available suggests that both anaerobic and aerobic effort is required for use of force situations.

INJURY/ABSENTEEISM DATA

The majority of the 19 agencies were able to provide on-duty injury and/or absenteeism data covering a time span from one to four years. Those data were analyzed to determine if 1) a potential cause of the injury or disability could be a low level of fitness (poor aerobic power, strength, flexibility etc.) and 2) the major area of injury (orthopedic, cardiovascular and injury site such as knee). The injury/absenteeism data are summarized in table C3.

TABLE C3
INJURY/ABSENTEEISM TRENDS

<u>AGENCY</u>	<u>REPORTED INCIDENTS</u>	<u>FITNESS RELATED AND AREA</u>
Brigham City	27 incidents	= 5 (18%) fitness related - knee = 2 (7%) of injuries - shoulder = 1 (3%) of injuries - back = 1 (3%) of injuries - ankle = 1 (3%) of injuries
Cedar City	20 incidents	= 6 (30%) fitness related - knee = 4 (20%) of injuries - back = 1 (5%) of injuries
Centerville	13 incidents	= 4 (30.8%) fitness related - back = 2 (15.3%) of injuries - knee = 2 (15.3%) of injuries
Escalanti	no data	
Kanab City	no data	
Layton City	18 incidents	= 6 (33.3%) fitness related - back = 4 (22.2%) of injuries - knee = 2 (11.1%) of injuries
Mapleton	no data	
Mt. Pleasant	no data	
Ogden City	46 incidents	= 8 (17.4%) fitness related - back = 1 (2.1%) of injuries - knee = 4 (8.7%) of injuries - ankle = 2 (4.2%) of injuries - cardio = 1 (2.1%) of injuries
Orem	49 incidents	= 17 (34.7%) fitness related - back = 7 (14.2%) of injuries - knee = 4 (8.1%) of injuries - ankle = 4 (8.1%) of injuries - cardio = 2 (4.1%) of injuries
Plain City	no data	

Riverdale	7 incidents	= 1 (14.3%) fitness related
		- back = 1 (14.3%) of injuries
Roy City	no data	
South Jordan	6 incidents	= 0 were fitness related
Springville	6 incidents	= 3 (50%) fitness related
		- back = 2 (33.3%) of injuries
		- knee = 1 (16.6%) of injuries
Spanish Fork	no data	
Unitah	no data	
West Jordan	no data	
West Valley	96 incidents	= 25 (26%) fitness related
		- back = 9 (9.4%) of injuries
		- knee = 11 (11.5%) of injuries
		- shoulder = 5 (5.2%) of injuries

TOTAL 288 incidents = 75 (26%) fitness related

- back = 26 (34.6%) of injuries
- knee = 30 (40%) of injuries
- ankle = 7 (9.3%) of injuries
- shoulder = 6 (8%) of injuries
- cardio = 3 (4%) of injuries

It is extremely difficult to glean specific information about injuries and absenteeism in order to draw definitive conclusions. Many inferences have to be made. Consequently, the data provided can only be interpreted as trend data. Given the data provided it appears that approximately 25% of the causes of injuries or absenteeism may be fitness related. That is - a lack of fitness would be a contributor the injury or condition. Orthopedic problems to the knee and back comprise approximately 75% of the injuries. Many of those types of injuries can be prevented by maintenance of good

fitness. These trends would suggest that the strength and flexibility of the upper leg, lower back and abdomen are critical fitness areas for performing the job as potential injury prevention factors.

FOCUSED PHYSICAL JOB-TASK ANALYSIS

While the previous data sources provided information regarding the 19 Police Department officer tasks, the data tend to describe the job tasks in general terms. This study's task analysis provided a more detailed definition of the job.

Several different data sources were obtained from the ratings of this study to describe the nature of the job. All approaches involved using the incumbent rating group as subject matter experts (SME) described in Section B to define the physical elements of the job. These analyses only focused upon the physical domain of the job. Mean ratings and standard deviations are reported for the group's ratings. Four rating areas are summarized: 1) physical job requirements, 2) job conditions, 3) physical fitness status required for the job and 4) specification of the physical demands of rated tasks.

The rating data from all the agencies were collapsed into one data base for statistical comparison purposes. There were **four major reasons** for that rationale: First, the existing job descriptions demonstrate a commonality of job requirements among all the agencies. Secondly, all sworn officers in Utah are held to identical POST requirements and must complete the same Basic Academy program with the same curriculum and skill mastery demands. Thirdly, having a larger data base provides the statistical power from which to draw valid conclusions about the most important job tasks and physical performance requirements.

The fourth reason, (and most important one) was based on a review of the data

from the subject matter expert (SME) ratings. Those ratings indicated a strong commonality among the ratings. The ratings from the SMEs of all reporting agencies (n=17), with the exception of one agency, had an approximate 84% agreement on the those tasks rated either frequent or critical. The one agency that did not have that agreement had only two officers. Statistically, it would not be possible single out that agency to collect or interpret any test data independently. A sample size of two is just too small.

The rationale for 84% is that it is the approximate %tile representative of 1 standard deviation above the mean. The standard deviation (sd) is a statistic that reflects the variation of test scores around the average score. It is generally accepted as a major cutpoint for viewing the significant differences between scores (if greater than 84%) or as an important indicator of significant correspondence among scores (if less than 84%).

1. PHYSICAL JOB REQUIREMENT RATINGS OF INCUMBENTS

The first incumbent rating area consisted of five-point ratings on the frequency and criticality of 46 physical tasks defined through the various data sources and past job-task ratings using the following scales:

FREQUENCY	1	2	3	4	5
	Never	Seldom	Occasionally	Frequently	Daily
CRITICALITY	1	2	3	4	5
	Unimportant	Important	Essential	Critical	Crucial

The ratings are defined as follows:

Frequency
 - Never = Never performed

- Seldom = Once a year or less often
- Occasionally = Once a month or less often
- Frequently = Weekly or bi-weekly
- Daily = Daily

Criticality

- Unimportant = Incorrect performance would not generally have a negative impact on the agency, the public, or yourself.
- Important = Incorrect performance would generally have a negative impact on the agency, the public, or yourself.
- Essential = Incorrect or lack of performance will negatively impact on the agency, the public, and yourself and may place the public or yourself in jeopardy for physical harm.
- Critical = Incorrect or lack of performance generally places the public or yourself in jeopardy for physical harm and potential loss of life.
- Crucial = Incorrect or lack of performance definitely places the public or yourself in danger of physical harm and potential loss of life.

Table C4 provides the means and standard deviations for the rating group. Using a rated score of 2.5 (rating midpoint) or above as an indication of frequent or critical tasks, the major conclusions from these ratings are as follows:

The incumbents rated standing, brisk walking, running short distances, upstairs and over uneven terrain: light and moderate lifting and carrying, carrying equipment up stairs, crawling, bending and reaching, dodging and jumping over obstacles, use of force for short term duration, use of control holds and restraining devices and ability to use forearms as the most **frequent** tasks. The same tasks were also rated **critical**.

Tasks rated **critical** but not as **frequent** include sustained running, heavy lifting and carrying, pulling, pushing heavy objects, dragging, extracting, climbing over obstacles, ledges and through windows, vaulting over obstacles, forced entry, use of

force (long duration), use of hands and feet, and pursuit driving.

TABLE C4
INCUMBENT PHYSICAL TASKS
JOB REQUIREMENT RATINGS

GENERAL PHYSICAL TASKS	FREQUENCY		CRITICALITY	
	\bar{x}	S.D.	\bar{x}	S.D.
1. STANDING for long periods	<u>3.4</u>	<u>0.5</u>	<u>2.5</u>	<u>1.4</u>
2. WALKING for extended hours	<u>2.5</u>	<u>0.9</u>	<u>2.4</u>	<u>1.0</u>
3. BRISK WALKING	<u>2.8</u>	<u>0.8</u>	<u>2.5</u>	<u>1.0</u>
4. RUNNING/SPRINTING in pursuit for short distances	<u>2.6</u>	<u>0.6</u>	<u>3.5</u>	<u>1.1</u>
5. SUSTAINED RUNNING in pursuit between 1-2 minutes	<u>2.1</u>	<u>0.6</u>	<u>3.2</u>	<u>1.1</u>
6. SUSTAINED RUNNING in pursuit for over 2 minutes	<u>1.8</u>	<u>0.6</u>	<u>3.0</u>	<u>1.2</u>
7. RUNNING UP STAIRS	<u>2.5</u>	<u>0.8</u>	<u>2.9</u>	<u>1.1</u>
8. RUNNING over uneven terrain	<u>2.5</u>	<u>0.7</u>	<u>3.0</u>	<u>1.0</u>
9. HEAVY LIFTING 100 lbs. or more	<u>2.3</u>	<u>0.7</u>	<u>2.9</u>	<u>1.1</u>
10. MODERATE LIFTING 26-100 lbs.	<u>2.9</u>	<u>0.8</u>	<u>2.9</u>	<u>1.0</u>
11. LIGHT LIFTING 25 lbs. or less	<u>3.5</u>	<u>1.0</u>	<u>3.1</u>	<u>1.1</u>
12. HEAVY CARRYING 50 lbs. or more	<u>2.3</u>	<u>0.8</u>	<u>2.8</u>	<u>1.0</u>
13. MODERATE CARRYING 26-50 lbs.	<u>2.6</u>	<u>0.8</u>	<u>2.8</u>	<u>1.0</u>
14. LIGHT CARRYING 25 lbs. or less	<u>3.3</u>	<u>1.0</u>	<u>3.0</u>	<u>1.1</u>
15. CARRY equipment up and down stairs	<u>2.7</u>	<u>1.0</u>	<u>2.7</u>	<u>1.1</u>
16. HOIST and LOWER equipment by rope	<u>1.3</u>	<u>0.5</u>	<u>1.7</u>	<u>0.9</u>
17. PULLING/Dragging heavy objects, people, equipment	<u>2.0</u>	<u>0.7</u>	<u>2.9</u>	<u>1.2</u>
18. PUSHING heavy objects or people	<u>2.4</u>	<u>0.8</u>	<u>2.9</u>	<u>1.1</u>
19. PULL SELF over obstacle	<u>2.4</u>	<u>0.7</u>	<u>3.2</u>	<u>1.2</u>
20. DRAG victims	<u>1.7</u>	<u>0.6</u>	<u>3.3</u>	<u>1.3</u>
21. EXTRACT victim from car or building	<u>1.8</u>	<u>0.6</u>	<u>3.4</u>	<u>1.2</u>
22. CLIMBING over obstacles (6')	<u>2.1</u>	<u>0.7</u>	<u>3.0</u>	<u>1.1</u>
23. CLIMBING over ledges	<u>1.8</u>	<u>0.7</u>	<u>2.7</u>	<u>1.1</u>
24. CLIMBING ladders and fire escapes	<u>1.8</u>	<u>0.7</u>	<u>2.4</u>	<u>1.2</u>
25. CRAWLING/STOOPING to get around objects	<u>2.6</u>	<u>0.8</u>	<u>2.9</u>	<u>1.1</u>
26. CLIMBING through windows	<u>2.2</u>	<u>0.6</u>	<u>2.9</u>	<u>1.0</u>
27. CLIMBING ropes	<u>1.2</u>	<u>0.4</u>	<u>1.9</u>	<u>1.1</u>
28. REPELLING with ropes	<u>1.2</u>	<u>0.4</u>	<u>1.9</u>	<u>1.2</u>
29. CRAWLING through tunnels/culverts	<u>1.4</u>	<u>0.6</u>	<u>2.1</u>	<u>1.0</u>
30. BENDING/REACHING to obtain objects or to get in and out of cars	<u>4.3</u>	<u>1.0</u>	<u>3.1</u>	<u>1.2</u>
31. DODGING/RUNNING to get around objects	<u>2.6</u>	<u>0.8</u>	<u>3.1</u>	<u>1.1</u>
32. JUMPING over obstacles (ditch)	<u>2.5</u>	<u>0.7</u>	<u>2.9</u>	<u>1.0</u>
33. VAULT over low obstacles (barricades)	<u>2.0</u>	<u>0.6</u>	<u>2.7</u>	<u>1.5</u>
34. VAULT over high obstacles (5')	<u>1.7</u>	<u>0.6</u>	<u>2.4</u>	<u>1.0</u>

35. BALANCE oneself on uneven or narrow surface	<u>2.1</u> <u>0.8</u>	<u>2.7</u> <u>1.1</u>
36. FORCED ENTRY using pushing/pulling	<u>2.3</u> <u>0.7</u>	<u>3.3</u> <u>1.1</u>
37. FORCED ENTRY by chopping	<u>1.3</u> <u>0.5</u>	<u>2.3</u> <u>1.1</u>
38. FORCED ENTRY using prying, sawing, cutting tools	<u>1.5</u> <u>0.6</u>	<u>2.4</u> <u>1.3</u>
39. USE OF FORCE for less than 1 minute to control a person	<u>2.9</u> <u>0.7</u>	<u>4.3</u> <u>0.9</u>
40. USE OF FORCE for an extended period of time over 1 minute to control a person	<u>2.3</u> <u>0.7</u>	<u>4.2</u> <u>1.0</u>
41. USE OF CONTROL HOLDS to subdue resisting person	<u>2.8</u> <u>0.8</u>	<u>4.1</u> <u>1.0</u>
42. USE OF RESTRAINING DEVICES to subdue resisting person	<u>2.9</u> <u>0.9</u>	<u>4.1</u> <u>1.0</u>
43. USE OF HANDS AND FEET self-defense techniques	<u>2.0</u> <u>0.7</u>	<u>4.0</u> <u>1.1</u>
44. SWIMMING	<u>1.2</u> <u>0.4</u>	<u>2.3</u> <u>1.2</u>
45. ABILITY to use firearms	<u>2.8</u> <u>1.2</u>	<u>4.3</u> <u>0.6</u>
46. PURSUIT DRIVING under emergency conditions	<u>2.7</u> <u>1.0</u>	<u>4.6</u> <u>0.7</u>

The average frequency and criticality ratings for the total group provides, in many respects, the most important information for defining the types of tasks that officers do. Tasks are independent of working conditions in that they are performed regardless of conditions. Consequently, a more detailed review of these ratings can be used to determine the degree of commonality of tasks officers perform in all 17 agencies.

The frequency and criticality ratings represent the average ratings for all agencies collapsed into one group. As was previously mentioned, a major rationale for collapsing the individual agency ratings into one total group was the assumption that there was enough commonality of frequent and critical tasks between agencies that they could be analyzed as one group for statistical purposes. That assumption was verified by a more in depth analysis of these data. There were four (4) steps to testing that assumption.

1. The most important commonality of physical tasks are those that are frequent and critical because those are the ones that the raters deemed important tasks

of the job. Only those tasks were analyzed for commonality.

2. Only those frequent and critical tasks that had an average total group rating of 2.5 or above were considered for making the agency comparisons. There were 33 tasks that met that criterion.

3. It is also important that the tasks used to test for commonality were also those tasks which well over the majority of 17 agency raters evaluated as frequent or critical. Just having a high total group mean does not necessarily mean that most of the agency raters rated those tasks as frequent or critical. Consequently, the 33 tasks were further analyzed and narrowed down to only those tasks that at least 84% (1 standard deviation) of the 17 agency raters evaluated as frequent or critical. Three tasks (standing for long periods, walking for extended hours, and brisk walking) did not meet that criterion. Only 52.9%, 52.9% and 58.8% respectively of the 17 agency raters evaluated those tasks as being frequent or critical.

4. Finally, there were 30 tasks that at least 84% of agency raters all rated as frequent or critical. The level of commonality among the agency raters on those 30 tasks is provided in Table C5.

TABLE C5
COMMONALITY AMONG AGENCIES ON PHYSICAL TASK RATINGS

<u>AGENCY</u>	<u>%TAGE COMMONALITY</u>
Brigham City	100%
Cedar City	100%
Centerville	100%
Escalanti	40%
Kanab City	100%
Layton City	100%
Mapleton	no data

Mt. Pleasant	96.6%
Ogden City	93.3%
Orem	100%
Plain City	90.0%
Riverdale	90.0%
Roy City	93.3%
South Jordan	100%
Spanish Fork	86.6%
Springville	90.0%
Unitah	no data
West Jordan	96.6%
West Valley	100%

These data clearly demonstrate that the same frequent and critical tasks are common to the job requirements of officers from all 17 agencies. The only agency that did not meet the commonality criterion of 84% was Escalanti. As was previously mentioned, that agency had only two officers and the sample size of too small to suggest any conclusion one way or another.

2. INCUMBENT JOB CONDITIONS RATINGS

The ratings on the variety of job conditions which the raters work under provide an additional view of the job environment. Each job condition was rated from a scale of 0 (no effect) to 3 (great effect). Table C6 shows the mean ratings and standard deviations. Major conclusions are as follows:

Using every rating above a mean of 2.0 (moderate) as the criterion, the raters

rated their job as being outside with risk of minor injuries; working around moving vehicles and toxic conditions, and with daily tasks that require attention to detail.

TABLE C6
INCUMBENT WORKING CONDITIONS RATINGS

<u>FACTOR</u>	<u>\bar{x}</u>	<u>S.D.</u>
1. INSIDE	<u>1.7</u>	<u>0.7</u>
2. OUTSIDE	<u>2.0</u>	<u>0.6</u>
3. LOW TEMPERATURE	<u>1.6</u>	<u>0.8</u>
4. HIGH TEMPERATURE	<u>1.8</u>	<u>0.7</u>
5. SUDDEN TEMPERATURE CHANGES	<u>1.8</u>	<u>0.8</u>
6. LOW HUMIDITY	<u>1.6</u>	<u>0.9</u>
7. HIGH HUMIDITY	<u>0.7</u>	<u>0.8</u>
8. WETNESS	<u>1.2</u>	<u>0.5</u>
9. SLIPPERY SURFACES	<u>1.2</u>	<u>0.5</u>
10. HIGH ELEVATIONS	<u>0.5</u>	<u>0.7</u>
11. CONFINED SPACES AND/OR CRAMPED BODY POSITIONS	<u>0.7</u>	<u>0.7</u>
12. VIBRATION	<u>0.6</u>	<u>0.8</u>
13. NOISE	<u>1.2</u>	<u>0.6</u>
14. DUST	<u>0.8</u>	<u>0.5</u>
15. ODORS	<u>1.0</u>	<u>0.5</u>
16. AIR PRESSURE	<u>0.2</u>	<u>0.2</u>
17. BODILY INJURIES (MINOR)	<u>2.0</u>	<u>0.8</u>
18. BODILY INJURIES (MAJOR)	<u>1.8</u>	<u>0.9</u>
19. MOVING VEHICLES OR OBJECTS	<u>2.2</u>	<u>0.9</u>
20. BURNS	<u>1.0</u>	<u>0.8</u>
21. NON-IONIZING RADIATION	<u>0.9</u>	<u>1.0</u>
22. SILICA DUST	<u>0.3</u>	<u>0.3</u>
23. ALLERGENIC	<u>1.2</u>	<u>0.8</u>
24. SMOKE CONDITIONS	<u>1.7</u>	<u>0.6</u>
25. TOXIC CONDITIONS	<u>2.0</u>	<u>0.7</u>
26. CHEMICAL IRRITANT	<u>1.6</u>	<u>0.6</u>
27. OILY	<u>1.6</u>	<u>0.4</u>
28. EXPLOSIVES	<u>1.8</u>	<u>0.5</u>
29. ELECTRICAL HAZARDS	<u>1.6</u>	<u>0.9</u>
30. IONIZING RADIATION	<u>0.7</u>	<u>0.4</u>
31. INFECTIONS	<u>1.2</u>	<u>0.8</u>
32. WORKING WITH OTHERS	<u>1.2</u>	<u>0.3</u>
33. RESPONSIBILITY FOR PERSONS	<u>0.5</u>	<u>0.4</u>
34. JOB COMPLEXITY	<u>0.7</u>	<u>0.7</u>
35. ROLE AMBIGUITY	<u>0.6</u>	<u>0.8</u>
36. IRREGULAR OR EXTENDED WORK HOURS	<u>1.2</u>	<u>0.6</u>
37. IRREGULAR EATING PATTERNS	<u>0.8</u>	<u>0.9</u>
38. IRREGULAR SLEEP PATTERNS	<u>1.1</u>	<u>0.8</u>

39. JOB STRESS	<u>0.2</u>	<u>0.8</u>
40. ATTENTION TO DETAIL	<u>2.0</u>	<u>0.4</u>
41. TRAVELING/JET LAG	<u>1.8</u>	<u>0.5</u>

3. INCUMBENT PHYSICAL FITNESS RATINGS

The Physical Fitness Ratings represent the extent the raters felt the underlying physical fitness factors were essential for job performance. The mean ratings and standard deviations for the rating group are presented in Table C7. The major conclusions are as follows: All physical fitness factors were rated toward the essential anchor (a rating of 3.5 or higher).

The ratings on physical fitness factors underscore that according to the rating group, a relatively high level of physical and health status functioning is deemed essential for performing the job. Besides rating the essential levels of each physical factor, raters were also asked to define a work task that represented each factor as an underlying dimension determining one's ability to perform that job task. For each factor, those tasks which were frequently listed are presented for the rating group. **The various tasks that the raters felt were representative of the fitness status factors correspond to the frequent and critical tasks** also rated in this section. There as correspondence by the incumbent raters. These agreements, in a separate rating, indicate that the various fitness status factors are viewed as underlying dimensions for performing a variety of tasks. The various sources of data all aid in defining underlying fitness areas that need to be addressed in specifying fitness standards.

TABLE C7
INCUMBENT FITNESS STATUS RATINGS

<u>FITNESS STATUS FACTOR</u>	<u>\bar{x}</u>	<u>S.D.</u>	<u>EXAMPLE WORK TASKS</u>
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1. ABSOLUTE STRENGTH	4.9	1.4	pushing vehicles/suspects, resistive arrests, lifting/carrying equipment/people pulling objects/people
2. EXPLOSIVE STRENGTH	5.1	1.5	foot pursuits, exiting vehicle, climbing objects/walls/stairs
3. DYNAMIC STRENGTH	5.2	1.4	physical arrests, defensive tactics, directing traffic
4. TRUNK STRENGTH	4.7	1.5	moving objects/cars/road debris, defensive tactics, force arrest
5. EXTENT FLEXIBILITY	4.8	1.4	getting in and out of vehicle, move in tight spaces, change a tire
6. ENDURANCE	5.0	1.5	foot pursuits, searching, walking, rescue operations
7. SPEED	4.9	1.6	short foot pursuits, rescue operations
8. ANAEROBIC POWER	5.1	1.5	making an arrest, defensive tactics, short chases
9. BODY COMPOSITION	4.6	1.6	running, working in tight places, climbing
10. GROSS COORDINATION (agility)	5.2	1.5	making an arrest, pursuit driving dodging obstacles
11. GROSS EQUILIBRIUM	4.8	1.5	running over uneven terrain, obstacles
12. BODY COMPOSITION (health-related)	4.9	1.5	public image, reduce stress
13. AEROBIC POWER (health-related)	4.9	1.4	reduce stress, good health
14. FLEXIBILITY (health-related)	4.9	1.3	injury prevention
15. STRENGTH (health-related)	5.1	1.3	injury prevention

4. PHYSICAL DEMANDS

In addition to rating the frequency and criticality of physical tasks the SME raters were also asked to quantify the physical demands of various physical tasks. The physical activities were categorized into 11 major physical activity areas that corresponded to the same physical tasks found to be frequent or critical. These defined demands aided in the definition of job tasks simulation scenarios that were eventually specified for the study. For each category, both total group (all 17 agencies) mean and median (50th & tile) scores were reviewed to ascertain which appeared most reflective of all 17 agency ratings. In some cases it was the mean, in others it was the median. The results are presented in Table C8.

TABLE C8
QUANTIFIED PHYSICAL DEMANDS

MOVEMENT CATEGORY	DEMANDS	
Standing time	Mean = 4 hours Range = 3-4 hours	
Walking time	Mean = 2.5 hours	Range = 2-3 hours
Walking distance	Mean = 4836	Range = 4400-5300
Running time	Mean = 4:27	Range = 4:11-5:23
Running distance	Mean = 1598 ft.	Range = 1500-1900 ft.
%tage time running in uneven terrain	Mean = 38%	Range = 34-40%
%tage time running around obstacles	Mean = 25%	Range = 19-26%
Running up/down stairs	Mean = 3.1 flights	Range = 2.8-3.3 flights
Jumping across obstacles	Mean = 4.3 ft.	Range = 4.1-4.3 ft.
Jumping over obstacles	Mean = 4.3 ft.	Range = 4-4.5 ft.
Jumping down from elevated surfaces	Mean = 6 ft.	Range = 4.8-6.2 ft.
Climbing over fence	Mean = 6 ft.	Range = 5.9-6.9 ft.
Lifting objects	Mdn = 75 lbs.	Range = 50-100 lbs.
Carrying objects	Mdn = 30 ft.	Range = 25-30 ft.
Pull dragging objects	Mean = 123 lbs.	Range = 113-134 lbs.

Pull/drag distance	Mean = 36.9 ft. Range = 33-39 ft.
Drag person	Mean = 206 lbs. Range = 190-207 lbs.
Dragging a person distance	Mean = 25.3 ft. Range = 25-33 ft.
Pushing a vehicle	Mdn = 35 ft. Range = 30-50 ft.
Crawling distance	Mean = 41 ft. Range = 39.7-43.8 ft.
Restraining a person	Mean = 201 lbs. Range = 189-206 lbs.

B. JOB TASK AND FITNESS TESTS DEFINITION

The various sources of data provided the necessary information from which to specify both the criterion job task simulation tests and the predictive physical fitness tests.

Job-task test definition

To narrow down the various job data for the purposes of specifying eventual tests, we had to first categorize the job related tasks. The various sources of job data yielded information that can be categorized into two broad areas: 1) specified physical tasks and 2) underlying physical fitness dimensions. The various tasks can be viewed as essential functions or bona fide occupational qualifications (BFOQs). The fitness areas can be viewed as the essential underlying factors for performing those essential physical tasks or functions. That categorization is presented in Table C9.

TABLE C9
DEFINITION OF CRITICAL AND ESSENTIAL
"PHYSICAL" JOB TASKS FROM DIFFERENT DATA SOURCES

<u>Essential (BFOQ) Specific Physical Tasks</u>	<u>Underlying Fitness Factors</u>
- Standing - Brisk walking	- Absolute strength - Explosive strength

- Running/sprinting for short distances
 - Sustained running (1-2 minutes and > 2 minutes)
 - Climbing over obstacles
 - Running up stairs
 - Running over uneven terrain
 - Jumping over obstacles
 - Extracting victim from car or building
 - Crawling and stooping
 - Heavy, moderate and light lifting//carrying
 - Bending and reaching
 - Dodging
 - Pulling/dragging heavy objects, people, equipment
 - Pushing heavy objects or people
 - Pull self over obstacle
 - Jumping/vaulting over obstacles
 - Forced entry using pushing/pulling
 - Use of force > 1 minute
 - Use of force < 1 minute
 - Use of control holds
 - Use of restraining devices
 - Use of hands and feet
 - Ability to use firearms
 - Pursuit driving under emergency conditions
- Dynamic strength
 - Trunk strength
 - Extent flexibility
 - Endurance (aerobic power)
 - Anaerobic power
 - Agility
 - Balance
 - Body composition

In an attempt to further elaborate and focus upon the definition of tasks from which to define representative job task tests, critical and frequent job requirement ratings were categorized according to body part and movement/activity modality of tasks. Only those tasks were included which met the frequency and/or criticality inclusion criteria (2.5) or above on the rating. Incumbent data are presented in Table C10.

TABLE C10
JOB TASKS RATED BY
BODY PART AND MOVEMENT FOCUS

LOWER BODY

<u>Standing</u>	<u>Walking</u>	<u>Run/Sprint</u>	<u>Run/Jog</u>
For long period	Brisk	Short distances	Sustained running

	Running up stairs	Running over uneven terrain	
UPPER BODY			
<u>Push-Pull</u>	<u>Lift</u>	<u>Carry</u>	<u>Drag</u>
Self Heavy objects People	Light lifting Moderate lifting Heavy lifting	Light carrying Moderate carrying Heavy lifting	Victims Extractions Objects
TOTAL BODY			
<u>Crawl</u>	<u>Jump</u>	<u>Bend and reach</u>	
Around objects	Around objects Over obstacles	To obtain objects In and out of cars	
<u>Climb</u>	<u>Use of force</u>	<u>Dodging</u>	
Through windows Over obstacles	Forced entry Use of force < 1 min. Use of force > 1 min. Use control holds Use restraining devices Use of hands and feet	Objects	
NOT CLASSIFIED BY BODY PART			
<u>Driving</u>	<u>Shooting</u>		
Emergency conditions	Use firearms		

The contractor team used this categorized task list to define three (3) job task scenarios containing the major physical tasks that could be quantified objectively to serve as job-task tests. Based upon previous validation studies, as well as this study's data, the majority of frequent and critical tasks could be sequenced within three basic "real world" scenarios that officers have to undergo in the course of their duties. Law enforcement officers never perform a physical task in isolation, but in combination with

other tasks within a defined situation. These scenarios represent example situations which officers have performed or are expected to perform.

In addition to the scenarios containing only those tasks that were deemed as frequent or critical functions by the SME raters, the physical parameter demands of the various job tasks (in terms of duration, distance, weight) were only those demands that the SME raters defined for each task. The mean or median measures of central tendency (Table C8) were utilized to define the specific event parameters of the three scenarios. As a consequence, the scenarios reflect only those tasks and task specifications which the SMEs defined. This clearly suggests that the scenarios are **valid representations** of the physical situations and tasks that the officers of the different agencies perform. The three scenarios were presented to the Fitness Coordinators of the different agencies and they concurred that the three scenarios are reflective of what they must do on their job. The three scenarios are described below.

SCENARIO # 1 CLEARING A ROADWAY

- Situation** The officer comes across a stalled car and debris in a busy intersection of a highway. He/she must get the car and debris off the road as soon as possible.
- Tasks**
1. On the command "GO" the officer exits his/her vehicle and runs 10 feet to the debris in the road (a barbell weighing 75 lbs.).
 2. Officer picks up the barbell and carries as fast as possible 30 feet to edge of the intersection.
 3. Officer runs back to car and drags 120 sack (duffel bag in a cardboard box) 35 feet to edge of intersection.
 4. Officer runs 35 feet back to the car and pushes car 35 feet to edge of the intersection.
- Equipment** Subject to be tested
1. Dressed in sweat suit or duty uniform.

2. Belt, gun, radio, vest, baton

Setting the testing situation

1. 2 vehicles 10 feet apart
2. 75 lb. barbell beside the vehicle
3. 120 lb sack beside the vehicle
4. 3 traffic cones to mark where the barbell and sack should go and where the car should be pushed to.
5. Stop watch.

Administration

1. Walk the subject through the test situation.
2. Explain that time is the measure - the faster the better.
3. At the command GO the subject starts.
4. When the officer pushes the car to the 35 foot finish line (marked by a traffic cone) the time is recorded.

Measurement

1. Time in seconds and tenths.
2. Effectiveness/ineffectiveness rating
 - * The time it takes is too long.
 - * Can not lift and carry the debris
 - * Can not push the car
 - * Uses poor technique which would limit the ability to perform the tasks in a real life situation

SCENARIO # 2 VICTIM EXTRACTION

Situation The officer comes across an accident scene and must pull out a victim from the car and drag the victim to a safe distance because there is spilled gasoline surrounding the vehicle.

Tasks

1. On the command "GO" the officer exits his/her vehicle and runs 30 feet to victims car.
2. Officer pulls out 190 lb. dummy from vehicle. Officer must open the car door and drag the dummy out the door.
3. Officer drags dummy 25 feet.

Equipment

Subject to be tested

1. Dressed in sweat suit or duty uniform.
2. Belt, gun, radio, vest, baton

Setting the testing situation

1. 2 vehicles 30 feet apart
2. 190 lb. dummy
3. 1 traffic cone at 25 foot mark
4. Stop watch.

Administration

1. Walk the subject through the test situation.
2. Explain that time is the measure - the faster the better.
3. At the command GO the subject starts.
4. When the subject drags the dummy past the 25 foot finish line (marked by traffic cone) time is recorded.

Measurement

1. Time in seconds and tenths.
2. Effectiveness/ineffectiveness rating
 - * The time it takes is too long
 - * Can not get the dummy out of the car
 - * Drags the dummy in a harmful manner
 - * Can not drag the dummy the full distance
 - * Uses poor technique which would limit the ability to perform the tasks in a real life situation

SCENARIO # 3 FUGITIVE PURSUIT AND ARREST

Situation

The officer is charged with pursuing and restraining a fugitive. The various obstacles are simulations of both urban and rural barriers that may need to be surmounted in a pursuit situation.

Tasks

PURSUING

1. Subject starts at traffic cone and runs 30 yards (90 feet) to a fence.
2. Subject goes over a six (6) foot fence and runs 20 yards (60 feet) to stairs (marked by traffic cone)
3. Runs up and down 12 steps x 3 times
4. Runs 30 yards (90 feet) to track. (marked by 1 traffic cone).
5. Runs 1020 feet (340 yards) on track to a traffic cone.
6. Subject turns and runs 10 feet
7. Jumps a ditch 4 feet apart (marked by 4 traffic cones).
8. Runs 60 feet
9. Serpentine around 10 cones spaced 10 feet apart.(total distance 100 feet)

10. Turns and runs 10 feet.

11. Jumps over a 4 ft. foot sawhorse or hurdle

12. runs 60 feet to 190 lb. dummy

RESTRAINING

13. Dummy is on his back

14. Subject rolls dummy onto stomach

15. While down on one knee, pull resistance tubing with each arm to midline of the body. (simulation of cuffing)

16. Stands up and lifts 190 lb. dummy up to knees up position.

Equipment Subject to be tested

1. Dressed in sweat suit or duty uniform.
2. Belt, gun, radio, vest, baton

Setting the testing situation

1. Fence adjacent to track.
2. 440 yard or 400 meter track.
3. 4 ft. sawhorses or hurdle
4. 18 traffic cones.
5. Two rubber resistance bands tubing.
6. 190 lb. dummy
7. 2 assistants to hold rubber tubing and blocking bag
8. Stop watch.

Administration

1. Walk the subject through the test situation.
2. Explain that time is the measure - the faster the better.
3. At the command GO the subject starts.
4. When the officer lifts the dummy up the time is recorded.

Measurement

1. Time in minutes and seconds converted to seconds.
2. Effectiveness/ineffectiveness rating
 - * The time it takes is too long
 - * Can not make it over, under or through an obstacle
 - * Walks too much through the course or up and down the stairs
 - * Can not perform the restraining tasks proficiently (cant deliver forceful blows)
 - * Uses poor technique which would limit the ability to perform the tasks in a real life situation

2. DEFINITION OF UNDERLYING FITNESS DIMENSIONS

In an attempt to define the underlying physical fitness variables associated with each job task test, the contractor judgment team performed the following categorization for each job task scenario (see Table C11). This categorization served as hypothesized relationships which would be verified through the statistics generated from the validation testing process.

TABLE C11
PHYSICAL DEMAND CATEGORIZATION FOR JOB TASK TESTS

	<u>Job task Scenario</u>		
	<u>Pursuit and arrest</u>	<u>Clearing roadway</u>	<u>Extraction</u>
A. Modality	Run/Dodge/Climb/Sprint/Jump/Crawl/Lift/Pull	Push/Lift/Carry	Sprint/Pull/Drag
B. Intensity	Anaerobic and aerobic	Anaerobic	Anaerobic
C. Duration	Approximately 2-3 minutes	Approximately 40 seconds	Approximately 15 seconds
D. Anatomical Focus			
Body Parts	Total Body	Total Body	Total Body
Muscle Groups	Deltoids, Triceps, Biceps, Pectorals, Abdominals, Deltoids, Quadriceps, Hamstrings,	Biceps, Quadriceps, Hamstrings, Latissimus Dorsi, Deltoids, Triceps, Abdominals	Quadriceps, Hamstrings, Triceps, Abdominals, Pectorals, Deltoids Erector spinae

	Trapezius	Erector spinae	
E. Fitness Areas			
Strength	X	X	X
Endurance	X		
Speed	X	X	X
Muscular endurance	X	X	
Range of motion	X	X	X
Leg power	X	X	X
Agility	X		

While body composition was rated as an underlying essential fitness factor, it is not included in the physical demand classification. Research has indicated that the effect of body composition on performance is minimal if aerobic power and strength are accounted for. In other words, the measurement of body composition does not add any significant information or predictability if the other two areas are addressed. Likewise, addressing body composition raises a red flag under the Americans with Disabilities Act (ADA) since some are contending that body fat is a handicapping condition. Thomas and Means concluded that body composition is not a necessary condition to address for officers' capability to perform strenuous physical tasks.

Based upon the physiological categorization for the job task tests, nine (9) field fitness tests (including % body fat) were selected as representative tests to measure the underlying physiological variables. A detailed description of each test with reliability and validity data is presented below.

PHYSICAL FITNESS BATTERY

1.5-Mile Run

A measure of aerobic power. Reliability coefficients reported between $r=0.75-0.90$ and predictive validity coefficient of $r=0.74$ with max V_{O_2} (AAHPERD 1984; Cooper 1968). Scoring is time (in minutes and seconds) to run 1.5 miles.

Sit and Reach Test

A test of static or extent lower back and upper leg range of motion or flexibility.

Reliability coefficients have been reported between $r=0.84-0.98$ (AAHPERD 1984).

This test is accepted as face valid or content valid defining lower back range of motion and flexibility (Wells and Dillon 1952). Scoring is inches reached in extension.

One Minute Bent-Leg Sit-Up Test

A measure of the muscular endurance or dynamic strength of the abdominal muscles in the trunk. Reliability coefficients have been reported at $r=0.68-0.94$ (Johnson and Nelson 1974). The sit-up test is accepted as face and content valid defining muscular endurance or dynamic strength (Fleishman 1964). Scoring is number of sit-ups completed in one minute.

Maximal Push-Up Test

A measure of upper body extensor muscular endurance or dynamic strength.

Reliability coefficient reported at $r=0.88$ with a validity analytic factor loading of 0.68 for dynamic strength (Fleishman 1964). Scoring is maximum number of push-ups.

300-Meter Run

A measure of anaerobic capacity and speed. Validity coefficients with measures of anaerobic power have been reported between $r=0.67$ and $r=0.76$ (Scott et al. 1990).

Scoring is time to run 300 meters.

Vertical Jump

A measure of leg power. A validity of 0.78 has been reported with the criterion of a sum of four track and field event scores. Reliability has been reported as high as 0.93 and an objectivity coefficient of 0.93 has been obtained (Johnson and Nelson, 1979).

Scoring is the number of inches between the standing reach and the jumping reach.

The Illinois Agility Run

A measure of agility for muscular coordination and movement. Reliability and validity coefficients for this test have not been performed (Cureton 1970). However, an Agility Dodge Test similar to the Illinois agility run has been evaluated with reliability coefficients of r . between .80 and .93 and a validity coefficient of .82 concurrently with over 16 other agility tests (Johnson and Nelson 1974). Scoring is time to complete the course.

One Repetition Maximum Bench Press

A measure of absolute strength of the major muscle groups of the upper body. Reliability coefficient has been reported at $r=0.93$ (Johnson and Nelson 1974). This test is accepted as face valid or content valid defining upper body maximum absolute strength. Scoring is maximum pounds predicted from a submaximal effort. A ratio of pounds pushed divided by body weight is also scored.

Skinfold Measurement

A predictive measure of body composition. Reliability coefficient reported at $r=.095$ and predictive validity coefficient of $r=0.90$ with underwater weighing assessment of body composition (AAHPERD 1984, Pollock, 1975). Scoring is % body fat.

CONCLUSION

The various sources of job task data all point to the conclusion that there are defined physical demands which the incumbent officers of the 19 agencies officer may be confronted with in a critical situation. While two of the 19 agencies did not provide JTA data, the level of commonality among the other agencies would suggest that these conclusions are valid for those agencies as well.

The definition of the physical job task scenario tests and physical fitness tests reflects the critical physical demands of the job and the underlying physiological

readiness variables that would be required to successfully perform the job. The data at this level of analysis suggest the job-task tests have face or content validity and the fitness tests have construct validity. As such, they are valid representative tests to be employed for the validation testing to determine standards. The incumbent testing data confirm these assumptions and further define officer criterion performance.

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. One Repetition Maximum Leg Press

A measure of absolute strength of the major muscle groups of the lower body.

Reliability coefficient has been reported at $r=0.92$ (Morrow et al.1995). This test is accepted as face valid or content valid defining lower body maximum absolute strength.

Scoring is maximum pounds pushed one time. A ratio of pounds pushed divided by body weight is also scored.