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## Pre-employment functional capacity assessment and remedial intervention program for the New South Wales police

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**PRE-EMPLOYMENT FUNCTIONAL CAPACITY ASSESSMENT  
AND REMEDIAL INTERVENTION PROGRAM FOR THE  
NEW SOUTH WALES POLICE**

A thesis submitted in partial fulfilment of the  
requirements for the award of the degree

Master of Science (Honours)

from

University of Wollongong

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2001

## **Abstract**

Assessment of physical capacity prior to employment serves a vital function in ensuring police recruits have the physical capability to perform essential policing functions. In the past, law enforcement agencies have used a variety of physical assessments to exclude potential candidates. The assessment criterion that has been used has lacked appropriate validation with critics arguing that the tests are invalid, irrelevant and potentially discriminatory. Additionally, the tests that have been used have focused on the assessment of policing specific skills prior to any skill-based training.

For many years, sports scientists have used physiological assessments to identify specific weaknesses in the performance capability of athletes. The individual physiological assessments that are utilised are chosen to assess the functional components of the sport concerned. The results of these assessments are used to develop an effective remedial intervention program resulting in increased sports performance. This same concept can also be applied to a police training and recruitment program.

The general aim of this study was to develop a pre-employment functional capacity assessment program that can accurately predict inadequate performance capability as well as determining specific weaknesses in underlying physiological capacity. This allows potential recruits who have less than the required physical capacity to be provided with targeted remedial intervention.

The research method required identifying operational policing tasks that are essential for the performance of general duties policing. An analysis of these tasks was then performed to determine the underlying physiological components required for successful task performance. Physiological assessments were selected and applied to policing students undergoing training in operational policing tasks. These results were analysed to determine their success in identifying ineffective performance capability. Additionally, a group of recruit candidates undertook the physiological assessments before and after a 14-week remedial intervention program to determine individual changes in physiological capacity.

The results indicate that the identified physiological assessments are successful in predicting ineffective task performance. Additionally, the potential recruits who were tested and then provided with education and remedial intervention demonstrated a significant increase in physical performance capacity. The proposed functional capacity assessment program allows for education and remedial intervention of potential candidates who have been identified with less than adequate performance capability. This helps ensure that efficient use is being made of recruit training funding and therefore serves to maximise the effectiveness of police training resources.

## **Acknowledgements**

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## **Definitions**

***'functional capacity'*** is the underlying physical requirements necessary (not including skill) for the successful performance of a specific task or function.

***'functional capability'*** is the ability to successfully complete a applied task or function. Functional capability is determined by a combination of performance related factors including physiological capacity, skill, reaction time, visual acuity, motivation and self confidence.

***'pre-employment functional capacity assessment'*** is the application of physical capacity assessment prior to employment to ensure that individuals possess the underlying physical requirements necessary to perform essential work tasks/functions.

***'physiological assessments'*** are individual physical tests often utilised in sports science to assess the underlying functional components of the sport/activity and therefore to identify specific weaknesses in performance capability.

***'essential policing tasks'*** are the tasks/functions which are essential to the role of a police officer.

***'operational skills training'*** is the training that is provided to policing students which focuses on physical tasks essential to the performance of operational policing. This includes weaponless control, use of equipment (batons, handcuffs, oleoresin capsicum spray, firearms etc.), crowd control and operational safety tactics (building search, bomb search, persons and vehicles).

***'operational skills instructors'*** are police training officers who are well experienced in the provision of operational skills training and responsible for conducting competency-based assessment in relation to the performance of physical policing tasks.

***'operational skills assessment'*** is a direct assessment of the skills and performance of physical policing tasks.

***'intensity'*** (*of policing tasks*) refers to the degree of effort required to successfully perform a particular activity.

***'frequency'*** (*of policing tasks*) refers to the regularity that an activity is required to be performed.

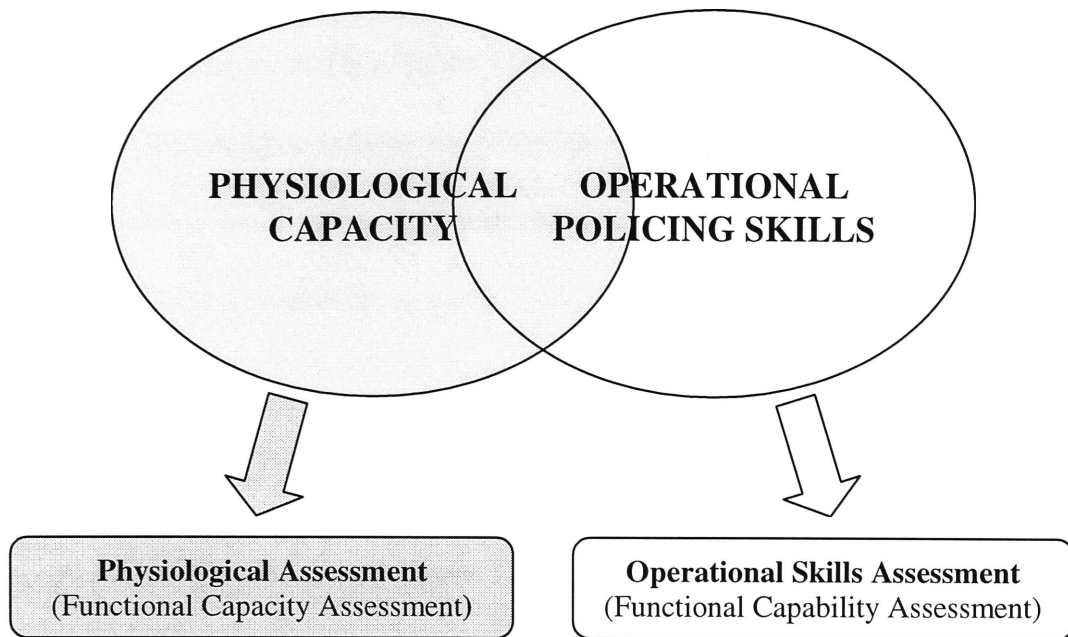
***'criticality'*** (*of policing tasks*) refers to how crucial it is for the successful performance of a particular activity considering the consequences of failure.

## **CHAPTER 1: INTRODUCTION**

### **1.1 Introduction**

For many years police organisations throughout Australia and overseas have required potential employees to undergo physical testing as part of the selection process for recruits. The physical criterion that has been applied has caused some concern as to its validity. The tests that have been used, which focus on the exclusion of candidates who fail to meet a nominated standard, have left the police service open to litigation on a number of issues. For example, the physical testing usually requires satisfactory performance on an obstacle course that is supposed to represent a series of tasks likely to be undertaken in policing duties. However, the activities undertaken may not represent current policing duties, and also require the successful performance of tasks with a high skill level prior to any skill-based training. Critics argue that the current tests are invalid, irrelevant and potentially discriminatory. Potential litigation under Anti-Discrimination Legislation and Equal Employment Opportunity (EEO) is also problematic.

The application of valid physical capacity assessment to potential recruits is vitally important for a variety of reasons. From a training perspective, it ensures that individuals possess the underlying physiological requirements (functional capacity) necessary to successfully undergo skill-based training and assessment (functional capability) (see figure 1.1). Without this underlying physical capacity, skill acquisition will prove difficult and recruit-training resources will be wasted. A successful physical assessment program should be able to identify specific weaknesses in performance capacity so that remedial intervention can be targeted.



**Figure 1.1 Effective performance of essential policing tasks.**

This figure schematically shows the interrelationship between physiological capacity (functional capacity) and operational policing skills (functional capability). Without the underlying physiological capacity the successful performance of operational policing skills would not be possible.

Physical assessment also aids in reducing the risks associated with a law enforcement occupation. The Police Service, as an employer, has a 'duty of care' obligation under Occupational Health and Safety Legislation (New South Wales Occupational Health and Safety Act, 2000) to ensure that its employees are physically capable of performing operational duties. A police service that does not address the physical requirements and needs of officers is susceptible to litigation as a result of negligent employment of individuals who are not physically capable of performing the job. Litigation from failure to ensure physical capability has already occurred in the United States (Tennessee v Garner, 1985; Parker v. District of Columbia, 1988).

Valid physical assessment relates to the capability of officers to perform essential functions of the job and therefore aims to ensure officers possess the underlying

physical capacity. In doing so, it may reduce the need for excessive use of force. For example, it may ensure that a situation can be successfully controlled, prior to it escalating to the need for firearm use. Furthermore, valid physical assessment ensures that the police service is better able to meet many of the legal requirements to avoid litigation and have a defensible position if pre-employment procedures are challenged in court. Pre-employment procedures must be adequately validated if they are to withstand legal challenge.

A number of strategies may be used to validate pre-employment physical assessment including content-related validation, construct-related validation and criterion-related validation. In the past, many police organisations have attempted to validate using content validity. Content validity refers to the degree to which the content measured by a test is the same as the properties of a specific job task or function. Tests that purport to have high content validity are generally task simulation tests such as obstacle tests. For example, if an officer were required to chase an offender and then climb over a two-metre fence in a typical foot pursuit situation, then part of the pre-employment test would measure the ability to run a distance followed by climbing a fence.

Construct validity refers to a test's ability to measure an underlying factor or dimension that is a characteristic of an officer's ability to perform a variety of physical tasks. For example, upper body strength as an underlying factor for an officer's capability of restraining offenders, pushing/pulling objects, lifting and carrying tasks. An individual physiological test has the ability to measure an underlying factor that accounts for performance on a variety of physical tasks.



Criterion validity refers to a test measuring a dimension that is predictive of an officer's ability to perform the essential and/or critical functions of the job. The test is predictive or correlated with criterion performance of job tasks.

The use of obstacle-based testing (reputedly content related) is flawed due to a number of important weaknesses. Obstacle-based tests attempt to replicate operational policing duties, but because these duties are so diverse it is difficult to replicate all of these duties in a one off test. This style of testing also assesses tasks that are skill based prior to any skill-based training. It is unreasonable to expect recruit applicants to be able to perform policing specific skills prior to any policing specific training. Furthermore, obstacle-based tests that incorporate several tasks cannot identify specific weaknesses in performance capacity. For example, during the performance of an obstacle-based test it may actually be the fatigue resulting from a lack of aerobic capacity, rather than the lack of lower limb strength/power that interferes with the individual's ability to negotiate an obstacle. Thus, any remedial intervention advice cannot be provided with confidence.

Obstacle courses require applicants to run long distances and negotiate multiple obstacles in succession. However, it has been shown that many of the activities performed in operational policing are performed in isolation, rather than sequentially. In fact, officers are more likely to be required to perform short bursts of strenuous activity negotiating a few relatively easy obstacles such as the typical suburban fence (Criminal Justice Commission & Queensland Police Service, 1998; Circelli & Wilson - NPRU, 1998). Additionally, because current obstacle tests are not reflective of essential policing duties, potential recruits are being excluded based on the performance of tasks not representative of criterion duties.

The current pre-employment obstacle courses may require a competency level considerably higher than that demanded of officers in the field. Furthermore, there is no research to suggest that differences in the capacity to perform the obstacle course are related to differences in ability to achieve a successful outcome in the police environment. The question of obstacle test validity thus remains unanswered. A related problem arises in setting timed cut-offs to decide those who pass and those who fail. Maher (1984) argues that these timed cut-offs do not bear any relationship to the successful performance of the critical duties of a police officer. Female applicants have recorded significantly higher failure rates than males on the obstacle course (Prenzler, 1996), and if this pre-employment tool is scientifically and legally invalid, litigation may result.

Obstacle-based tests also fail to provide content or construct validity. As discussed previously, a job task simulation test battery accounts for only a small percentage of all physical tasks. Physiological testing may be more predictive in the performance of essential tasks. For example, upper body strength is a component of a number of operational tasks, whereas assessment of an individual task would be specific to that particular task performance. While the concept of content validity has been well understood by law enforcement organisations, it appears that criterion and construct validity have been often misunderstood. This may have led to an assumption that individual physiological assessments cannot be validated as job related and the reason why organisations have replaced physiological testing with job task simulation tests.

Tests that discriminate between individuals are not illegal *per se*. The ideal tests from a selection point of view, are those that can discriminate between an individual who can

perform duties effectively, efficiently and safely and those who can not. Such tests are by definition, job related. Consequently, the rationale for job relatedness must be based upon both a construct and criterion based validity. Thus, it is important that pre-employment physical assessment is able to identify applicants who are not physically capable of performing the requirements of the job (screening out). Some police organisations have used pre-employment physical assessment to identify potential high performers by setting a high cut-off and reduce applicant numbers (screening in). This method of selection is not valid and if challenged in court may be found discriminatory.

In the past, the physical nature of policing was used to justify the use of height, weight and age restrictions for recruitment and selection. It was in the United States during the 1970's that law enforcement agencies were unable to convince judicial tribunals of the occupational relevance of minimum height requirements. By the late seventies, having been denied the use of minimum height restrictions, United States law enforcement agencies resorted to the use of obstacle course type tests. These tests were subjected to legal challenge based on EEO Legislation, which most agencies were unable to defend. The Los Angeles Sheriff's Department was successful however in defending their obstacle-based test in the California Supreme Court. In 1986, the New South Wales Police Service implemented an obstacle-based test that was adapted from the one utilised by the Los Angeles Sheriff's Department.

Recent changes to the structure of applicant training and employment have provided the NSW Police Service with particular challenges and opportunities. On the 18<sup>th</sup> May 1998, Charles Sturt University in conjunction with the NSW Police Service commenced the University based 'Diploma of Policing Practice'. To become a NSW Police Officer,

applicants must complete a year of a university diploma before applying to join the NSW Police Service. The move to university based learning as a prerequisite for police recruitment arises from a recommendation of the Wood Royal Commission into Policing in New South Wales (1996) with the aim of increasing the professional status of the vocation.

The move to university based training has created substantial changes to the recruitment process. Applicants apply to Charles Sturt University for admission into the Diploma in Policing Practice and are selected on their likelihood of success in the program based on their qualifications/prior studies and experience. They must also meet the professional suitability requirements of the Police Service, which include citizenship or permanent residency, and examination of criminal and traffic history. Applicants also require a medical clearance from a doctor that investigates occupational related health issues and clears the individual for participation in maximal physical activity during training.

Recent changes to the NSW Police Service training and recruitment process provides the opportunity to develop an innovative physiological assessment and remedial intervention program that can be applied to potential recruits. The challenge of this study was to develop a successful pre-employment assessment program that is both scientifically valid and able to be implemented considering the constraints of the training and recruitment framework.

## **1.2 Aims and hypothesis**

The aims of this study are:

- 1) Identify essential policing tasks and determine the underlying physiological requirements necessary for successful task performance;
- 2) Select and apply physiological tests and determine their ability to identify individuals who cannot effectively perform essential policing tasks;
- 3) Develop a functional capacity assessment program and evaluate the effectiveness of an associated remedial intervention program;
- 4) Make recommendations to improve and enhance the application of the physical assessment screening process and the associated physical training program.

Thus the hypotheses for this study are:

- 1) The identification and analysis of essential policing tasks will allow a determination of the underlying physiological demands required for successful task performance;
- 2) The application of selected physiological assessments will provide an accurate determination of the functional capacity required for successful task performance and subsequently be capable of predicting ineffective performance of essential policing tasks;
- 3) A pre-employment functional capacity assessment program that correctly identifies specific weaknesses in performance capacity will provide the opportunity for

education and remedial intervention which when applied will result in significant increases in the physical capacity of recruit applicants.

In summary, the purpose of this study was to develop a pre-employment functional capacity assessment program that can accurately identify individuals with inadequate performance capability as well as determining specific weaknesses in their underlying physiological capacity. This allows potential recruits to be provided with targeted remedial intervention resulting in increased performance capacity.

## **CHAPTER 2: LITERATURE REVIEW**

### **2.1 Pre-employment physical assessment**

There have been a large number of reports and reviews investigating the use of physical tests for the exclusion of potential recruits. Many of the research studies in the past have focused on the content validation of obstacle-based tests. One of the reasons why there has been a focus on content related evidence of validity may be that it is easier to convince people of the association with operational duties. It is far more difficult for people to see how construct and criterion related evidence relates to the performance of actual job skills, and thus how it can be legally defensible.

Police organisations have tended to believe that if they can accurately identify the tasks performed during operational policing, that this will indeed validate the use of obstacle-based tests. One of the earliest attempts at providing content-based evidence validity was by Osborn (1976). After identifying the physical activities undertaken by 152 deputies from the Los Angeles County Sheriff's Department, the author recommended the use of an obstacle course based test. The author suggested that the test should consist of a six foot wall climb, a 440 yard run, body transport, a balance beam, vehicle push and a crawling test. Booth and Hornick (1984) recommended the use of an obstacle-based test after investigating the duties performed by 42 Officers from Colorado. It was recommended that the obstacle test consist of tasks that assess upper body strength, leg strength, grip strength, balance/coordination and reaction time. It is interesting to note that although the authors identified the underlying physiological components, they recommended that these components be assessed using an obstacle-based test.

A study conducted by Farenholtz & Rhodes (1986a & 1986b) copied the methodology used by Osborn (1976), and investigated the physical duties performed by 217 Canadian officers. The authors recommended the use of obstacle type tests as a pre-employment screening tool. They called the test the POPAT (Police Officer Physical Ability Test) which consisted of a 440-yard obstacle course that required a six-foot running broad jump, sharp turns, up and down stair climbs and obstacles. The applicants then had to control 80 pounds of resistance by pushing and pulling on a rotational arm, followed by a modified squat thrust and standing task. Following this was a three-foot rail vault, agility activity and a 100-pound sack carry of 50 feet. Recommended minimum standards were reported (Farenholtz & Rhodes, 1990).

A study conducted in the United States by Arvey, Landon, Nutting and Maxwell (1992) investigated the physical duties performed by police officers. They completed their analysis by reviewing 100 Use of Force Incident Reports, obtaining a detailed description of physical activities by 12 officers and also by distributing a survey form to officers that rated the frequency and importance of 72 physical activity items. The authors recommended using a combination of obstacle course and other physical tests designed to measure strength and endurance. The obstacle course they recommended involved jumping a hurdle and ditch, zig zagging through some markers and climbing over a six-foot fence while covering a distance of 60 yards. They suggested that the additional tests should consist of a 100-yard dash, a dummy drag (120 pounds, 50 feet), grip strength, dummy wrestle (80 pound dummy), sit-ups (number/minute), bench dips (number/minute) and a one mile run.



A conference of law enforcement officials in the USA in 1993 compiled a list of basic functions for law enforcement and suggested that any physical assessment should reflect an ability to perform these functions. Pilant (1995) designed an obstacle-based test to try to represent these tasks. The test consisted of 20-40 yard sprints interspersed with climbing a five to six-foot wall, a four-foot horizontal jump, stair climbing and dragging a 160 to 170 pound dummy 50 feet. Recruit testing also included a separate 1.5 mile run and a dry fire of a service weapon 5 times with dominant and non-dominant hand.

Collingwood (1995) reviewed job task surveys, job descriptions and the list of basic functions compiled at a 1993 USA law enforcement conference to identify physical job functions, as well as frequent physical job tasks and critical tasks. It was recommended that physical assessment should concentrate on 6 underlying components of fitness such as cardiovascular endurance, anaerobic power, muscular strength, muscular endurance, flexibility and body composition. The author also attempted to provide criterion-related and construct-related validity by reporting that these six components of fitness correlated with an officer's performance of physical tasks and also correlated with supervisor ratings of officer performance.

Until 1986, the New South Wales (NSW) Police Service required recruit applicants to be a maximum of 35 years of age and a minimum height of 173 centimetres for males and 163 centimetres for females. The application of Equal Employment Opportunity and Anti-Discrimination Legislation also resulted in the abandonment of these restrictions. In response, the Police Service implemented obstacle-based tests as a means of selecting recruit applicants. The obstacle test that was implemented was

adapted from the one that was designed and used by the Los Angeles Sheriff's Department.

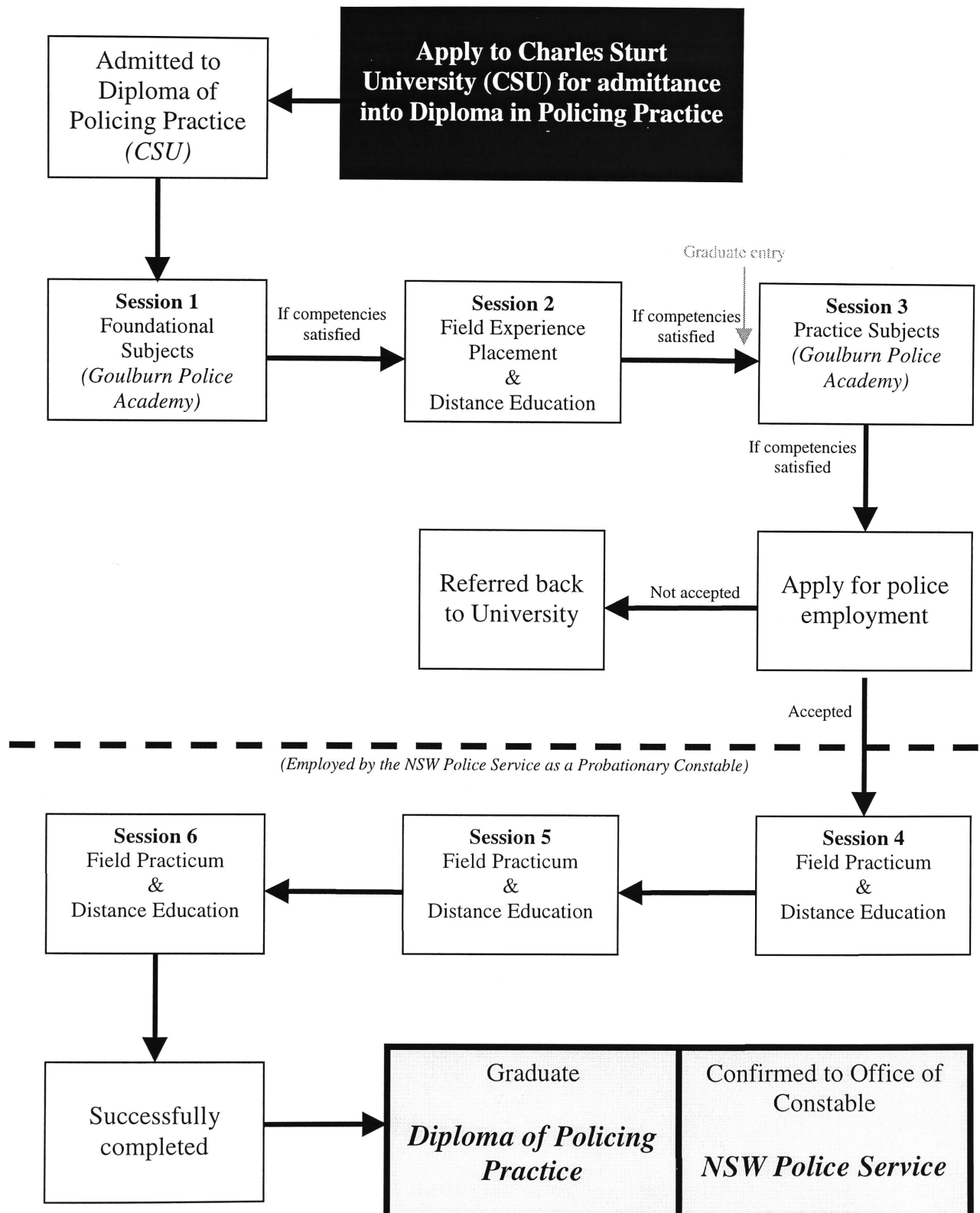
Until recently, the NSW Police Service has used what was called a 'Physical Agility Test'. The total distance covered during the test was 630 metres. During the test the applicant was required to wear a 3.4 kg weighted belt and successfully negotiate obstacles located at various intervals. The obstacles included an 80cm timber rail fence, a 165cm paling fence, walls with low and high window openings, a concrete pipe and a 2 metre mesh fence. Applicants were also required to traverse through agility bars, walk along a low balance beam, run 260 metres, drag a 75kg human shaped dummy for 7 metres and then operate a handcuff simulator. In addition to this obstacle based test, the applicants were required to demonstrate their capacity to hold, load, grip and squeeze the trigger of a standard issue revolver and show proof of the ability to swim 100 metres. Skinfold measurement testing was also performed using 3 sites with the 'desirable' score being below 20% body fat for males and 28% for females which was calculated using the Jackson and Pollock formula (1985).

Other police organisations in Australian and New Zealand have used some form of physical testing prior to an applicant gaining successful employment. Some use obstacle course based tests and others use these tests combined with individual tests (Appendix A).

## **2.2 The new education, training and recruitment framework for the NSW Police Service**

The newly developed Diploma in Policing Practice consists of six sessions of 14 weeks completed over two years (see Figure 2.1). The course integrates field-based education with classroom study. Sessions 1 and 3 are taken on campus at the NSW Police College in Goulburn. Sessions 2, 4, 5 and 6 involve field-based education and study in the distance learning mode. To qualify for the award of Diploma of Policing Practice, students must successfully complete 16 subjects, field experience placements in session 2 and field practicums in sessions 4, 5 and 6 (see appendix B). Graduate entry students or applicants whose recognised prior learning affords them the academic standing equivalent to that of graduates, receive credit for sessions 1 and 2 and commence studies from Trimester 3. They are however, required to complete an additional subject, Introduction to Policing B. Students do not become employees of the NSW Police Service until after session 3 when all competencies are satisfied and their application for employment is successful.

The subject 'JST100 Physical Skills and Operational Safety', commences in semester 1 and finishes at the end of semester 3. This subject involves the physical components of the course and consists of six modules that run concurrently. All students undertake physical fitness training and operational skills training. The operational skills training includes weaponless control, use of equipment (batons, handcuffs, oleoresin capicum spray, firearms etc.), crowd control and operational safety tactics (building search, bomb search, persons and vehicles) (See appendix B). Satisfactory completion of this subject is a requirement for NSW Police Service employment.



**Figure 2.1 The new education, training and recruitment framework for the NSW Police Service.** Within the new training and recruitment framework, course participants are University students (non-employees) for sessions 1, 2 and 3. If they are successful in gaining employment after session 3, they will obtain the status of 'Probationary Police Constable'.

### **2.3 Essential policing tasks**

Policing duties performed within Australia differ somewhat from those performed by Police Officers within overseas jurisdictions. This is due to a variety of factors including the powers provided to officers under law and also the equipment issued to assist in the performance of operational duties. Thus, it is vitally important that the determination of essential policing tasks be related to those undertaken within Australia.

A recent research study conducted by the National Police Research Unit (Circelli & Wilson, 1998) investigated the activities encountered during general duties policing throughout Australia. Data were collected using a purpose designed survey form, which enabled officers to rate tasks quantitatively. Police officers were asked to record the physical activities undertaken during the performance of three nominated tasks/jobs for five shifts that they worked. The three nominated tasks/jobs were the first at the start of the shift, the second of the shift and the first after a meal break. The results were based on a total of 5878 tasks, arising from 2241 shifts undertaken by 461 officers.

The results indicated that the most frequently occurring physical activities undertaken during policing tasks are those that were described as less demanding or simple, such as driving under non-emergency conditions, getting into and out of a car, and walking short distances (up to 30 metres). The more demanding physical activities that were undertaken were running short distances, restraining a person, pulling oneself up onto and jumping down from an obstacle generally of medium height (1-2 metres), hurdling an obstacle of low height (up to 1 metre) and wrestling and handcuffing a person. These activities were performed less frequently and were not all undertaken during the same policing task.

The data from each individual task were also analysed to determine if any study participants had performed the series of physical activities found in their respective jurisdiction's obstacle course. The results indicated that not one participant was required to undertake a combination of physical activities comparable to the obstacle course in their jurisdiction. This evidence does not support the content validity of these obstacle courses.

A study conducted by the Criminal Justice Commission (CJC) in conjunction with the Queensland Police Service (1998) investigated 'The physical requirements of general duties policing'. Using questionnaires, the researchers attempted to quantify the routine physical requirements of operational police work. The survey was administered randomly to constables and senior constables and was completed by 357 officers. Data were collected on a variety of topics including how officers spent their time during their last shift, physical activities they were required to perform throughout the previous 12 months, and the number and nature of injuries they received while on duty in the 12 months. Demographics such as age, gender and area of duty were also recorded.

The data indicated that managing non-compliant offenders is one of the most frequent and critical demands placed on police officers and that this is also the most likely time for an officer to sustain an injury. Officers also reported that they were often required to lift, carry, move or drag objects or people.

Over the previous twelve months, 96 percent of officers reported struggling with an offender and 85 percent indicated that they had been required to carry/move and restrain a person. 70 percent of officers reported having to break up fights and control crowds and 13 percent of respondents had indicated the use of their baton in the previous 12

months. The greatest amount of time was reported as spent driving or sitting in a police vehicle followed by sitting at a desk. More than 50 percent reported having taken part in a high-speed pursuit either as a driver or passenger. 36 percent of respondents indicated that they had been required to draw a firearm, with 16 percent having pointed it at an offender and only 0.3 percent having discharged their weapon. 3 percent of officers reported being required to swim more than 10 metres.

The survey results indicated that officers are more likely to engage in short bursts of physical activity such as running to an incident and wrestling with an offender, than to have completed long pursuits on foot with multiple consecutive obstacles. Many of the activities identified were performed in isolation rather than sequentially. These findings also question the content validity of existing obstacle courses and their suitability as a tool for use in recruitment.

The survey confirmed that there were a wide range of physical demands placed on police but the authors questioned the validity of expecting recruits to be able to do tasks rarely required of currently serving police officers prior to the start of the recruit training program. The authors argued that many of the activities identified by the survey would usually be performed in isolation rather than sequentially, which is the focus of an obstacle based course.

A research project conducted by the University of Queensland (CPASE, 1998) investigated operational policing duties by direct shift monitoring and auditing, profiling through fitness assessments and simulations of critical events. It was reported that the data collected during the shifts were consistent with the results of the survey

data of the National Police Research Unit (1998), and the CJC and Queensland Police Service study (1998).

The physiological analysis indicated that the average energy expenditure per shift was modest and insufficient to maintain optimal endurance capacity. A biomechanical analysis was performed based on the results of the direct shift monitoring and analysis of the critical event simulation. It was reported that the most biomechanically demanding tasks are manual handling of non-compliant persons, manual handling of objects (pushing, pulling, lifting and carrying) and prolonged exposure to whole body vibration as the driver or passenger in vehicles. The authors identified the core physical activities for policing as: run a moderate distance while wearing fully equipped uniform, access and drive police vehicles, use firearms, perform rescue from water, perform manual handling of persons and objects, restrain non-compliant persons and perform effective self defence.



### **CHAPTER 3: GENERAL METHODS**

The first step of this study was to investigate and determine the physical demands of general duties policing. The initial part of the process involved utilising the data obtained from recent Australian based research to identify essential policing tasks considering frequency, intensity, and criticality. The underlying physiological components required for effective task performance were identified through task simulation and subsequent analysis. Subject matter experts contributed to the determination of effective performance technique and this information was utilised within the analysis. Based on the results of the task analysis, a subjective evaluation was completed to provide a qualitative determination of the physiological requirements underpinning successful task performance.

The next stage of the study was to select a series of scientifically valid tests that assess the physiological components underpinning successful task performance. These physiological tests were then applied to graduate entry Diploma in Policing Practice students during the time that they were undergoing operational skills training. Additionally, each student was assessed on their physical capability to perform operational tasks using purpose designed assessment criteria (Appendix F).

Subject matter experts (police operational skills instructors) were used to conduct the operational skills assessment based on their expertise in determining successful performance and also their ability to identify factors responsible for unsuccessful performance. These data were analysed to determine the relationship between physiological test performance and policing task performance.

The final stage of this study was to determine whether the identification of specific weaknesses in performance capacity and the targeting of remedial intervention result in a significant increase in performance capacity. The selected physiological tests were applied to graduate entry Diploma in Policing Practice Students before and after 14 weeks of remedial intervention to determine the success of intervention and ease of implementation of the proposed physical assessment program. A functional capacity assessment program was then developed and evaluated taking into consideration the framework constraints.

## **CHAPTER 4: IDENTIFICATION AND ANALYSIS OF ESSENTIAL POLICING TASKS**

### **4.1 Introduction**

The modern policing environment has changed substantially over the years. Although remaining very dynamic and diverse in nature, both technology and duties performed have caused considerable changes in the physical requirements. Although a large proportion of policing duties are reasonably sedentary such as taking statements and report writing, police officers must have the capability of performing all essential physical tasks effectively and efficiently, especially those tasks that are critical. It is acknowledged that it is not only an officer's physical capability that determines the outcome of a critical situation, but other skills such as an officer's conflict resolution skills (Wilson, 1996), communication ability and proficiency with non-lethal weapons (Hamdorf, Boni, Webber, Piki & Packer, 1998). Other environmental factors may also have an influence such as the state of mind of the offender and the availability of back up. It is however imperative that officers be physically capable of successfully performing these critical tasks.

From a legal perspective, it is important that police organisations select recruits with the physical qualities necessary to be effective police officers and do not use exclusion criteria that have not or can not be validated. Under EEO and Anti-Discrimination Legislation, recruitment and selection tests must be directly related to the inherent demands of the job. Determining the physical requirements of performing general duties policing is the first step towards developing appropriate and valid procedures for pre-employment physical assessment. Furthermore, it is important to ensure that

essential policing tasks are identified based on the inherent requirements of general duties policing and not as a result of the police operational systems.

The determination of physical activities that are genuine occupational requirements of policing requires consideration be given to frequency, intensity and criticality. Intensity refers to the degree of effort required to successfully perform a particular activity.

Frequency refers to the regularity that an activity is required to be performed.

Criticality refers to how crucial it is for the successful performance of a particular activity considering the consequences of failure. Although some tasks occur infrequently, it is vital that they can be performed effectively and efficiently because of their criticality.

## **4.2 Methods**

An investigation and analysis of the data obtained from recent Australian based research (Circelli & Wilson - NPRU, 1998; CJC & Queensland Police Service, 1998; University of Queensland - CPASE, 1998) was performed to determine essential policing tasks.

Highly experienced police operational skills training instructors ( $7.6 \pm 4$  years experience) were observed performing the identified tasks using correct performance technique which was recorded on videotape using a Panasonic Super VHS video camera. Additionally, the instructors were interviewed regarding correct performance technique. Using the information that was obtained, an analysis of each policing task was completed to determine the physiological requirements underpinning successful task performance.

### 4.3 Results

An investigation and analysis of the research data obtained from Circelli & Wilson - NPRU (1998), CJC & Queensland Police Service (1998) and University of Queensland - CPASE (1998) revealed 12 physical tasks essential to operational policing (Table 4.1).

**Table 4.1 Identified essential physical tasks for operational policing.**

1. Effective use of the Glock 22 standard issue pistol
2. Restrain and/or handcuff non-compliant person
3. Apply effective self-defence
4. Lift/carry objects or persons
5. Push/pull objects or persons
6. Jumping onto, over or down from an obstacle
7. Run short distances
8. Run moderate distances
9. Walking
10. Accessing and driving motor vehicles
11. Engage in crowd control
12. Swim a short distance

The analysis of each of the essential policing tasks determined seven physiological components essential to the successful performance of operational policing duties (Table 4.2, 4.3 & 4.4).

**Table 4.2 Qualitative analysis of essential policing tasks.**

This table outlines the frequency, intensity, and criticality of the identified essential policing tasks and also summarises the broad physiological requirements necessary for successful task performance.

Activity	Frequency	Intensity	Criticality	Anaerobic		Aerobic	Muscular strength	Muscular endurance	Sprint speed	Agility	Torso strength/stability
				ATP-PC	Glycolysis						
1. Use firearm effectively (Glock 22)	L	M	H	High	Medium		High	Medium			Medium
2. Restrain and/or handcuff non-compliant person	M	H	H	High	High	Low	High	Medium			High
3. Apply effective self-defence (baton, weaponless)	L	H	H	High	High	Low	High	Medium			High
4. Lift/carry objects or persons	L	H	M	High	Medium	Low	High	Medium			High
5. Push/pull objects or persons	L	H	M	High	Medium	Low	High	Medium			High
6. Jumping onto, over or down from an obstacle	L	H	M	High	Low		High	Low			Medium
7. Run short distances	M	H	H	High	Medium	Low	High	Medium	High	High	High
8. Run moderate distances	L	M	M	Medium	Medium	Medium	Medium	High	Medium	Medium	Medium
9. Walking	H	L	L	Low	Low	Low	Low	Medium			Medium
10. Accessing & driving motor vehicles	H	L	M					Medium			Medium
11. Engage in crowd control	L	H	H	Medium	Medium	Medium	High	Medium	Medium	Medium	Medium
12. Swim a short distance	L	M	H	Medium	High	Medium	Medium	Medium			

(L = Low, M = Medium, H = High)

**Table 4.3 Underlying physiological components required for successful performance of each essential policing task.**

<b>Activity</b>	<b>Primary factors</b>	<b>Secondary factors</b>
1. Use firearms effectively (Glock 22)	Forearm/handgrip strength	Shoulder girdle strength/endurance, finger strength
2. Restrain/handcuff non-compliant person	General upper body strength, forearm/handgrip strength, torso strength/stability	
3. Apply effective self-defence (baton, weaponless etc.)	General upper body strength, lower limb strength, forearm/handgrip strength, torso strength/stability	
4. Lift/carry objects or persons	Lower limb strength, torso strength/stability, general upper body strength	Forearm/handgrip strength
5. Push/pull objects or persons	General upper body strength, lower limb strength, torso strength/stability	Forearm/handgrip strength
6. Jumping onto, over or down from an obstacle	Lower limb strength	General upper body strength
7. Run short distances	Lower limb strength, sprint speed, agility	
8. Run moderate distances	Lower limb strength, aerobic capacity, muscular endurance	
9. Walking	Aerobic capacity	Muscular endurance
10. Accessing & driving motor vehicles		Torso strength/stability
11. Engage in crowd control	General upper body strength, lower limb strength, torso strength/stability, sprint speed	Forearm/handgrip strength
12. Swim a short distance	Anaerobic capacity	Aerobic capacity, general upper body strength/endurance





**Table 4.4 Summary of the identified physiological components essential for operational policing tasks.**

1. Forearm/handgrip strength
2. General upper body strength
3. Lower limb strength/power
4. Torso strength/stability
5. Agility
6. Short sprint ability
7. Aerobic capacity

## **4.4 Discussion**

### *4.4.1 Effective use of the Glock 22 standard issue pistol*

Being able to accurately discharge the Glock 22 standard issue pistol is essential to the role of general duties policing (Circelli & Wilson - NPRU, 1998; CJC & Queensland Police Service, 1998). Although this task occurs infrequently, it is critical that an officer be able to use the weapon effectively if the situation dictates. The Glock 22 is a 0.40 calibre, semi-automatic, self-loading pistol with a magazine that holds 15 rounds of ammunition.

A thorough investigation of the Glock 22 pistol reveals that this type of weapon relies on the force of the spent ammunition to reload the next live fire, using a sliding mechanism. This is different from the operation of a revolver that is often standard issue in other police jurisdictions. The Glock 22 pistol must be held firmly in order to ensure reliable functioning. If the pistol is held with a weak grip then the pistol recoiling in the hand absorbs some of the energy required in the operation of the slide. This can result in the slide not travelling fully to the rear before returning forward with the result being a blockage, also termed a 'stovepipe' malfunction (Conway, 1997). In

addition to this possible blockage, weak grip strength can cause a range of other problems including the weapon dropping low before firing, accentuated recoil, inaccurate shots and increased time for readjustment back to the centre of target after firing. If the pistol is held with a strong grip the pistol will function correctly (Conway, 1997).

The implication of an officer possessing weak grip strength is that the individual is placing both themselves and possibly the public at risk in the event of a critical incident. A moderate degree of shoulder girdle strength/endurance is required to provide stability of the arm. Only when infrequent activities such as extended building searches are performed, is there a need for the pistol to be held in the 'drawn position' for long periods of time. A high level of finger strength is also suggested as being necessary for the operation of the slide and the loading of the magazine with ammunition (Conway, 1997). During the firearms training program, students are required to perform firing of the weapon using both hands (standard grip), single dominant hand and single non-dominant hand. In the field, police officers are required to be able to fire the weapon single handedly, should the situation dictate.

An analysis of the methods involved in discharging the Glock 22 pistol revealed that the most important physical components required for correct use of the Glock 22 pistol are hand, wrist and forearm strength. Both an experienced weapons instructor and a novice with poor handgrip strength were used as part of this analysis. Many of the muscles involved in providing hand, wrist and forearm strength contribute indirectly and as a result of their isometric contraction maintain wrist and forearm stability during the discharge of the weapon. Some of these muscles (extensors) aid in maintaining the wrist in an extended position during the discharge of the weapon. Secondary factors

involved in effective and efficient use of the Glock 22 pistol include shoulder girdle strength/endurance and finger flexor strength.

#### *4.4.2 Restrain and/or handcuff non-compliant person*

Restraining offenders and the handcuffing of offenders are essential to the role of general duties policing. Managing non-compliant offenders is one of the most frequent and important physical demands placed on police officers (Circelli & Wilson - NPRU, 1998; CJC & Queensland Police Service, 1998). Ineffective performance capability not only results in inability to perform an essential policing function, but also increases the risk of personal injury. Restraining non-compliant offenders has been shown to be the most frequent 'activity at time of injury' (NSW Police Service – Occupational Health & Safety Section, 1993-1998; CJC & Queensland Police Service, 1998).

Although skill is a very important component of restraining and handcuffing, there is an underlying level of physical capacity required for the successful performance of these operational skills. There are a variety of techniques used in the restraint of non-compliant persons. The technique chosen may depend on a number of factors including the size, strength and level of resistance demonstrated by the offender.

An analysis of the methods involved in effectively restraining an offender and the handcuffing of an offender revealed that the most important physiological components required for successful task performance is a high level of general upper body strength/endurance and torso strength/stability. The muscles responsible for general upper body strength/endurance are the muscles that move the arm and shoulder girdle. Abdominal strength is recognised as being central to the maintenance of correct posture during both dynamic and static exercises. Additionally, forearm/handgrip strength is an important component of successful task performance.

#### *4.4.3 Apply effective self-defence*

The application of effective self-defence is essential to the role of general duties policing (Circelli & Wilson - NPRU, 1998; CJC & Queensland Police Service, 1998). It is critical that an officer be able to defend against an offender if at risk of personal injury. Inability to perform effective self-defence may result in personal injury to the officer or may require the officer to use 'lethal use of force' methods that can result in death or serious injury of an offender.

Although the skill factor is acknowledged, if an officer does not possess the underlying physical capability they will not be able to perform self-defence effectively and efficiently. There are a variety of techniques used in performing effective self-defence and the technique chosen may depend on a number of contributing factors including the size, strength and level of resistance demonstrated by the offender.

An analysis of the methods involved in performing effective self-defence revealed that the most important physiological components required for successful task performance is a high level of general upper body strength, handgrip/forearm strength, lower limb strength/power and torso strength/stability.

#### *4.4.4 Lift/carry objects or persons*

Police officers are often called upon to lift, carry or drag objects and people (Circelli & Wilson - NPRU, 1998; CJC & Queensland Police Service, 1998). Lifting excessive weight and/or using incorrect lifting technique are significant causes of muscular strains and back injury (Mann, 1985). In fact, investigation of reported injuries for police officers indicate that the most common 'nature of injury' is sprains/strains and the most common 'location of injury' is the back (NSW Police Service, Occupational Health & Safety Section, 1993-1998).

Correct lifting technique involves using the strength of the legs rather than extension of the spine. In order to perform this task effectively with minimal stress placed on the lower back, an adequate level of lower limb strength is required. A combination of weak abdominals, tight hip flexors, tight back musculature and abdominal obesity contributes to postural change and increases the stress placed on the spine during lifting and carrying objects or persons.

#### *4.4.5 Push/pull objects or persons*

Police officers are often called upon to push or pull objects and persons (Circelli & Wilson - NPRU, 1998; CJC & Queensland Police Service, 1998). An adequate level of upper body strength, lower limb strength/power and torso stability is essential for performing such tasks. Individuals who have poor abdominal strength combined with tight lower back musculature may have an increased disposition to the development of lower back injury, especially when performing duties such as pushing or pulling objects and persons.

#### *4.4.6 Jumping onto, over or down from an obstacle*

Negotiating obstacles of low to moderate height (1-2 metres) is frequently performed by police officers (Circelli & Wilson - NPRU, 1998; CJC & Queensland Police Service, 1998). If obstacles are of greater height, officers may use another object such as a garbage bin to aid in the negotiation (*ibid*). Although some officers choose to negotiate obstacles of greater height such as a two-metre brick wall, it is generally a result of personal choice and not critical to do so (Circelli & Wilson - NPRU, 1998). Obviously a degree of skill is a component of obstacle negotiation. An analysis of the methods involved in performing obstacle negotiation reveals that the most important physiological components required for successful task performance is a high level of

lower limb strength/power. Additionally, general upper body strength is often necessary to aid in successfully negotiating an obstacle.

#### *4.4.7 Run short distances*

When police officers are required to run in critical situations, it is generally of high intensity for short distances of approximately 30-40 metres (Circelli & Wilson - NPRU, 1998; CJC & Queensland Police Service, 1998). Furthermore, during these short sprints officers are often required to display a high level of agility (*ibid*). The implications of an officer having either poor sprint ability or agility is that they may not be able to apprehend an offender, but more importantly they may also not be able to retreat from a dangerous situation when required. Additionally, when an officer is required to rescue a member of the public from critical danger, a high level of sprint ability is necessary to reduce the risk to the person. A high level of lower limb strength/power is essential to sprinting short distances quickly and efficiently.

#### *4.4.8 Run moderate distances*

When police officers are required to run moderate distances, the policing task is generally not as critical as that requiring short distances and is of moderate intensity (Circelli & Wilson - NPRU, 1998; CJC & Queensland Police Service, 1998).

Sometimes it is due to the choice of the individual officer to continue to pursue a fleeing suspect or offender; nevertheless, some essential tasks demand this capability. A moderate level of aerobic fitness and muscular endurance is required to sustain this activity and also to ensure that the officer does not demonstrate endurance fatigue that may impact on the performance of a consecutive critical task.

#### *4.4.9 Walking*

Walking is essential to performance of operational policing duties and is one of the most frequently reported physical activities performed by police officers (Circelli & Wilson - NPRU, 1998; CJC & Queensland Police Service, 1998). The intensity of the walking required is only low to moderate (*abid*), however if an officer possesses a poor level of aerobic fitness, this lack of capacity may cause endurance fatigue and interfere with other simple activities or critical tasks.

#### *4.4.10 Accessing and driving motor vehicles*

Accessing and driving motor vehicles is essential to the role of general duties policing (Circelli & Wilson - NPRU, 1998; CJC & Queensland Police Service, 1998). Modern operational policing is heavily reliant on motor vehicles. Extended periods of low level vibration are experienced as a result of travelling in a motor vehicle. Individuals who have poor abdominal strength/endurance may have an increased risk to the development of lower back injury (Taimela & Kankaanpaa, 1999) when performing duties such as driving or travelling in motor vehicles for long periods of time.

#### *4.4.11 Engage in crowd control*

Crowd control training is referred to during police recruit training as public order policing. It requires a moderate level of sprint ability to ensure that officers can relocate themselves quickly to where the crowd must be controlled or to perhaps form a human wall (Circelli & Wilson - NPRU, 1998; CJC & Queensland Police Service, 1998). A human wall can only be formed after the slowest person has reached the required position. Certainly if an officer has a poor sprint ability, agility and a lack of adequate aerobic capacity, then this may interfere with the performance of crowd control duties.

#### 4.4.12 Swim a short distance

It is critical that all police officers possess the ability to swim at least a short distance to either rescue a member of the general public from drowning or save themselves in such a situation (Circelli & Wilson - NPRU, 1998; CJC & Queensland Police Service, 1998). General duties police are very rarely called upon to perform a rescue of a drowning person (*abid*) but the consequences of an officer being unable to do so are extreme both in potential loss of life and legal liability of the organisation for failure to ensure an employee's work capability. Although the ability to swim a short distance requires an underlying level of anaerobic fitness and general upper body strength/endurance, a key performance indicator is the learnt skill of swimming. Time spent during recruit training would be more wisely spent teaching operational skills rather than teaching the skill of swimming. It is the author's recommendation that recruit applicants show documented proof of an ability to swim 100 metres. This requirement may be satisfied by a statement or certificate issued by a nationally accredited swimming instructor. The Royal Life Saving Society Bronze Medallion Award is a nationally accredited award which meets this criteria and also ensures that participants have the necessary skills to carry out water rescues.

In summary, this part of the study identified physical tasks that are essential to the performance of general duties policing. An analysis of these essential policing tasks revealed the underlying physiological components required for successful task performance.



## **CHAPTER 5: RELATIONSHIP BETWEEN PHYSIOLOGICAL ASSESSMENTS AND POLICING TASK PERFORMANCE**

### **PART A: TEST SELECTION**

#### **5.1 Introduction (test selection)**

For many years, sports scientists have used physiological assessments to identify specific weaknesses in the performance capability of athletes. The results of these assessments are used to develop an effective remedial intervention program.

Appropriate tests are chosen based on their scientific validity and their ability to identify underlying performance components (Gore *et al.*, 1998). When selecting physiological assessments to determine functional capacity prior to employment, the same principles need to be applied. Additionally, the ease of implementation needs to be taken into consideration. For example, although a maximal cardiorespiratory test with direct gas analysis and work capacity assessment may be extremely accurate as a measure of aerobic capacity, this type of test is neither feasible nor appropriate considering the framework constraints of the proposed functional capacity assessment program.

#### **5.2 Methods**

The assessments were selected to most accurately match the underlying physiological components required for successful performance of essential policing tasks. The other criteria that had to be considered when selecting tests included the ease of implementation, costing and portability. The underlying physiological components required for successful task performance were previously identified as:

forearm/handgrip strength, general upper body strength, lower limb strength/power, torso strength/stability, agility, short sprint ability and aerobic capacity. Additionally,

body composition assessment was included as part of the testing procedure because excess body fat has been identified as having a detrimental affect on the performance of many physical tasks.

### 5.3 Results

Physiological assessments were selected based on applicability and also after an investigation of advantages and any disadvantages. The protocols for each test are contained in Appendix D.

**Table 5.5 Identified physiological assessments.**

The assessments were selected to most accurately match the identified physiological requirements of essential operational policing tasks, taking into consideration the scientific validity, ease of implementation, and costing.

PHYSIOLOGICAL COMPONENT	PHYSIOLOGICAL ASSESSMENT
Forearm/handgrip strength	Handgrip strength dynamometer
General upper body strength	Push-up test
Lower limb strength/power	Vertical jump test
Torso strength/stability	7 stage abdominal strength test
Agility	Modified Illinois agility test
Short sprint ability (30-40 metres)	40 metre sprint
Aerobic capacity	Multi-stage fitness test (shuttle run)
Body composition	Skinfold measurements Waist measurement

## **5.4 Discussion**

### *5.4.1 Handgrip strength test*

An appropriate physiological assessment to determine hand, wrist and forearm isometric strength is the handgrip dynamometer. An accurate device currently available for use in this assessment is the 'Jamar Hydraulic Handgrip Dynamometer'. This device has been shown to be a repeatable and valid measure of grip strength (Mathiowetz *et al.*, 1984).

There are numerous other brands of handgrip dynamometers that are designed to measure handgrip strength. Most utilise a spring mechanism rather than hydraulics to determine the force exerted. Consequently, these devices often require a dynamic 'pumping' action rather than an assessment of isometric strength.

### *5.4.2 Push-up test*

The push-up test assesses general upper body strength/endurance. The major muscles involved in the push-up test include the Pectorals, anterior and medial Deltoids, Triceps, Rhomboids and Teres muscle groups. An implication in the use of push-ups to assess upper body strength is that the level of resistance provided is proportional to body mass and more specifically, upper body mass. However, when officers are in the field, body mass does play a role in the resistance provided in many policing tasks. This test is easy and practical to implement across a large group.

An alternative test that was investigated was the use of the bench press exercise. This test however requires specific equipment and also poses an increased safety risk, especially to individuals inexperienced with this activity.

### *5.4.3 Vertical jump test*

During operational duties, officers require dynamic strength of the lower limbs to perform a variety of policing tasks. Dynamic strength is defined as the maximal ability of a muscle to exert a force or torque at a specified velocity (Knuttgen & Kraemer, 1987). An appropriate physiological assessment to determine general lower limb strength/power is the vertical jump test. During the vertical jump test the musculature about the hips, knees and ankle act rapidly and with great force in an attempt to produce the greatest possible velocity as the body leaves the ground. The take off velocity ultimately determines the jump height. Performance in the vertical jump test, is determined by a complex interaction of several factors including the maximal force that the involved musculature can develop (leg strength), how fast that force can be developed (speed/power), and the neural coordination of the movement. A proportion of the power developed during the vertical jump test is derived from the stretch-shortening cycle that enhances muscular force by evoking the stretch reflex, and utilises elastic energy stored in the stretched tissues. Although the vertical jump test assesses mainly lower limb power, it also assesses overall jumping ability incorporating arm swing, trunk extension and leg extension. The arm swing in the vertical jump test has been shown to contribute approximately 10% to the jump height (Luhtanen & Komi, 1978).

Performance in the vertical jump test is also influenced by the ratio of power to body weight. Increased muscle mass of the lower limb may contribute to jumping ability whereas unnecessary body fat contributes to mass but does not contribute to lower limb power. Therefore if a test participant possesses a large amount of body fat, vertical jump test performance will be reduced.

In accepting any weaknesses of the vertical jump test, the vertical jump assesses overall jumping ability incorporating arm swing, trunk extension and leg extension; which are important components in assessing the capability of an individual to jump onto, over or down from an obstacle.

Two alternate lower limb strength/power tests that were investigated were the counter movement jump and the squat test. The counter movement jump is a vertical jump without the arm swing. By eliminating the arm swing it is intended that the counter movement jump test reduces involvement of the upper limb and focuses on the effort of the leg extensor muscles. This test however requires specialised equipment including a contact mat, timing module, computer and software. It also requires an amount of skill. The squat test requires specific equipment and poses an increased safety risk especially to individuals inexperienced with this activity.

#### *5.4.4 7-Stage abdominal strength test*

The 7-stage abdominal strength test is a progressive one-repetition maximum test of abdominal strength. Each consecutive stage increases in the resistance provided. The major abdominal muscles involved are the Rectus Abdominis muscle group, with the assistance of the External Oblique, Internal Oblique, Transverse Abdominis and Quadratus Lumborum muscle groups. An implication of the use of this abdominal strength test to assess abdominal strength is that the level of resistance provided is proportional to upper body mass. However, as upper body mass increases, so does the level of abdominal strength required for dynamic task performance.

Two other factors that may influence the level of resistance provided when performing this test are lumbar lordosis and abdominal obesity. Increased lumbar lordosis may result in anterior pelvic tilt and abdominal obesity may impede the direction of force

exerted by the abdominal muscle group. In acknowledging and accepting any disadvantages of this test, it is however a valid measure of general abdominal strength.

An alternate abdominal strength test was investigated was the 'pressure biofeedback stabiliser'. This test however requires an element of learnt skill and is unable to applied effectively across a large group.

#### 5.4.5 *Modified Illinois agility test*

The purpose of this agility test is to simply measure the ability to rapidly change body direction and position in the horizontal plane. Police work requires officers to run short distances often negotiating obstacles by quickly changing direction. The Illinois agility test has been used within sports science to assess agility (Draper & Lancaster, 1985; Corbin & Lindsay, 1985). It is a valid and reliable means of measuring horizontal agility (*ibid*). The original test format was modified to metric dimensions.

An alternate agility test that was investigated was the 505 Agility Test. It is a valid and reliable measure of agility in the horizontal plane (Draper & Lancaster, 1985).

However the Illinois Agility Test was determined as being more specific in relation to operational policing tasks.

#### 5.4.6 *40 Metre sprint test*

This test is a measure of short sprint ability and assesses the time taken to cover a distance of 40 metres from a standing start. The measurement of time is performed using infrared timing lights to help eliminate the risk of measurement error and the influence of reaction time. Lower limb strength/power is an important component of sprint performance.

#### 5.4.7 20 Metre shuttle run test

Collectively performing a number of activities consecutively requires a moderate level of aerobic capacity. Lack of cardiorespiratory endurance may result in fatigue during operational duties and long term it may also lead to an increased risk of cardiovascular disease. The 20 metre shuttle run test was developed by Leger and Lambert (1982), to determine a participant's maximum oxygen uptake. Test participants run back and forth on a 20 metre course and must reach the 20 metre line at the same time that a sound signal is emitted. The speed commences at 8.5 km/hr and increases at the rate of 1 km/hr every 2 minutes. When the participant can no longer keep pace with the sound signal, the last stage number announced is used to predict maximum oxygen uptake. The test takes approximately 7 to 12 minutes to complete.

The 20 metre shuttle run test is portable, scientifically valid, cost effective, requires minimal equipment and can be used to test large groups of people at one time. A high correlation has been established between performance on the 20 metre shuttle run test and maximal aerobic capacity as measured in the laboratory (Leger & Lambert, 1982; Paliczka, *et al.* 1987; Ramsbottom *et al.*, 1988; Gadoury & Leger, 1989; Sproule *et al.*, 1993; McNaughton, Hall & Cooley, 1998). This ensures that the 20 metre shuttle run is a valid and repeatable measure of maximal oxygen uptake and specifically aerobic running power.

A disadvantage of this test is that participants are unable to adopt an economical stride length. The acceleration/deceleration nature of this test may also contribute to an increased blood lactate concentration relative to running speed (Ahmaidi, Collomp & Prefaut, 1992). Furthermore, participants who have poor agility performance may be disadvantaged and this may reduce the test result. Because the test results are based on

maximal performance, participants who lack motivation or fail to put in maximum effort will not achieve a level relative to their physiological limit. It has also been suggested that the verbal cues indicating change in levels may influence subject drop out (Wilkinson, Fallowfield & Myers, 1999). In accepting any disadvantages of this test it is however a valid, repeatable and accurate means of assessing aerobic capacity.

The application of direct gas analysis and work capacity assessment is an extremely accurate as a measure of aerobic capacity, however this type of test is neither feasible nor appropriate considering the constraints of the proposed functional capacity assessment program.

#### *5.4.8 Skinfold measurements*

The conventional approach to the assessment of excess body fat has been to examine the height versus weight relationship called Body Mass Index (BMI). A shortcoming associated with such a relationship is that it does not take into account the muscularity of an individual. The use of skinfold measurements is considerably more accurate in the measurement of excessive body fat. Skinfold measurements can provide both a relatively accurate and direct measure of the amount of subcutaneous fat (Pollock, Schmidt & Jackson, 1980; Jackson & Pollock, 1985; Norton *et al.*, 1996). That is, they measure the thickness of the skin and underlying adipose tissue (predominantly fat). Skinfolds are surface measurements that, over time, have become associated with procedures to estimate whole body adiposity, including fat stored internally around organs and so forth. Since major health risks are known to be associated with body fat deposits located as deep stores such as abdominal fat, the challenge has been to quantify total body fat using simple, time and cost efficient methods.



Increased body fat has been associated with an increased incidence of disease. The 'metabolic syndrome' is a medical term used to describe a collection of symptoms which frequently co-occur: obesity, high blood pressure, high blood triglyceride levels, glucose intolerance, high cholesterol levels, and type II (non-insulin-dependent) diabetes mellitus (Whaley *et al.*, 1999). Excessive body fat (obesity) has been associated with an increased incidence of these other health-related disorders. Although this link is clearly established, it is difficult to determine at what level body fat becomes a significant health risk. As further normative data become available, it may be possible to identify relative disease risk.

From an employment perspective, the increased risk of health related disorders is far less important than the effect of excessive body fat on physical performance. Excess body fat can affect physical performance in a variety of ways. It negatively influences performance by adversely affecting mechanical, metabolic, and thermoregulatory attributes of the activity performed. Evidence from the literature has demonstrated an inverse relationship between fat mass and performance of physical activities requiring translocation of the body weight either vertically, such as jumping, or horizontally, as in running (Boileau & Lohman, 1977; Malina, 1992; Woolford *et al.*, 1993; Pate *et al.*, 1989). Excess fatness is detrimental to these types of activities because it adds mass to the body without additional capacity to produce force. Because acceleration is proportional to force but inversely proportional to mass, excess fat at a given level of force application will result in slower changes in velocity and direction (Boileau & Lohman, 1977; Harman & Frykman, 1992).

Excess body fat increases the metabolic cost of physical activities that require movement of the total body mass (Buskirk & Taylor, 1957). Thus, in most physical activities a high percentage of body fat would disadvantage an individual both

mechanically and metabolically (Boileau & Lohman, 1977). Cross-sectional research data also indicate that percentage body fat is inversely related to aerobic capacity ( $\text{VO}_{2\text{ max}}$ ) expressed relative to body weight (Cureton, 1992). Excess body fat may contribute to a reduced thermoregulatory ability by reducing heat dissipation, which in the case of a police officer, may be magnified by wearing a bulletproof vest.

Furthermore, back disorders are more likely in people with excess body fat because obesity creates an additional strain on the postural muscles of the lower back, especially if great amounts of fat are carried in the abdominal region. Finally, upper body dynamic strength may be reduced as fat adds additional mass to the body thus placing greater demands on the body musculature and therefore reducing physical performance.

Although skinfold measurements can be both an important and useful tool, these must be applied and interpreted in the correct way. In the interests of accuracy, it is important that any individuals performing skinfold testing are accredited. If testers are not professional trained and accredited in performing skinfold measures, there may be a high degree of variability. In recent years, the anatomical sites for testing skinfolds have been standardised by the International Society for the Advancement of Kinanthropometry (ISAK). A level of knowledge and skill is required to correctly identify skinfold sites and to use the correct technique with the skinfold caliper.

Inaccuracies in site identification combined with poor measurement technique can alter the result significantly (Pederson & Gore, 1996). Testing needs to be accurate and reliable with reproducibility displayed both by the tester and between different testers.

ISAK has introduced standards related to anthropometric measures. Their standards of measurement relate to the following: the observance of landmarks in the determination of measurement sites, the use of standard procedures and the continuous calibration of equipment (Norton, *et al.*, 1996). The sum of skinfolds measurement is obtained using

7 sites. These sites are the triceps, subscapular, biceps, supraspinale, abdominal, front thigh and the medial calf. They are recommended by the Australian Laboratory Standards Assistance Scheme (1998) as the standard to be used on men and women and in agreement with ISAK.

It is important that any measures are reported as a total 'sum of skinfolds' and not calculated to produce a percentage body fat. The equations used to calculate body fat percentage are based on a series of assumptions and can produce error. The result can vary significantly depending on the skinfold sites and equation that is used. The equations are also attempting to predict a total body fat percentage (including internal body fat) based on only superficial measurements.

Individuals being measured should be adequately hydrated as dehydration can effect the results of skinfold thickness measurement. Strenuous activity prior to testing should be avoided. Skinfold calipers should be calibrated and serviced annually and springs replaced on a regular basis, as skinfold thickness has been shown to vary directly with spring coefficient and inversely with jaw pressure (Gore *et al.*, 2000).

The World Health Organisation (WHO) has reported that the risk of obesity related health disorders significantly increases as a result of excessive abdominal obesity. They have recommended that males should have a waist measurement less than 102cm and females less than 88cm.

## **PART B: PHYSIOLOGICAL AND TASK PERFORMANCE**

### **ASSESSMENT OF POLICING STUDENTS**

#### **5.5 Introduction (physiological and task performance assessment)**

For pre-employment physical assessment to be legally valid it is imperative that it is job related and to achieve this it needs to be shown that performance in the physiological assessment relates to performance of essential policing duties. The crucial issue in the development of pre-employment screening is to ensure that poor performance in the physiological assessments correctly identifies individuals who cannot successfully perform essential policing duties and therefore distinguishes between those who can and cannot perform duties effectively and efficiently. The aim of this part of the study is to determine the relationship between performance in the selected physiological tests and performance in operational policing tasks.

#### **5.6 Methods**

73 graduate entry Diploma in Policing Practice students were physiologically assessed using the selected tests during their fourth week of operational-skills training. The elimination of a number of students from the data set was as a result of pre-existing injury/illness that prevented the participants from completing a particular physiological assessment. Two participants were unable to participate in the agility test, six in the 40 metre sprint and one in the multi-stage fitness test.

Because the tests were administered in succession, the tests were ordered to minimise the influence that a test had on the subsequent test. For example, the multi-stage fitness test (shuttle run) was not performed prior to the vertical jump test as fatigue resulting

from the shuttle run would effect lower limb strength/power performance. The following order was used: skinfold/waist measurements, handgrip strength, vertical jump test, abdominal strength test, push-up test, agility test, 40 metre sprint test and multi-stage fitness test. Skinfolds were used to measure subcutaneous fat deposits. A total of 7 sites were landmarked and measured in accordance with the procedures developed by the ISAK.

In consultation with staff from the Operational Skills Training Unit, a set of criteria was devised to identify individuals who demonstrated problems with operational training tasks based on physical capability rather than purely lack of skill. Operational skills training instructors are subject matter experts in the correct performance of physical policing tasks. The operational skills instructors were used to conduct the operational skills assessment based on their expertise in determining successful performance and also their ability to identify factors responsible for unsuccessful performance. They are well experienced in the provision of operational skills training and also responsible for conducting competency-based assessment in relation to the performance of physical policing tasks.

Five experienced operational skills training instructors ( $7.1 \pm 4.1$  years experience) assessed the students on their physical capability to perform individual operational tasks using the devised set of criteria (Appendix E). The instructors were screened for both inter and intra tester reliability.

The analysis of operational task performance was restricted to the operational training tasks that are currently part of the subject, JST100 Operational Skills (Appendix A.). The current curriculum does not provide skills training and assessment for all of the

essential policing tasks. For example, the capability to jump onto, over or down from an obstacle does not form part of the current operational skills training curriculum.

For a pre-employment physiological assessment to be valid, it needs to be effective in identifying individuals who cannot perform essential policing tasks. The successful performance of essential policing tasks results from a complex interaction of a variety of performance related factors including physiological capacity, skill, reaction time, visual acuity, motivation and self confidence. Hence, physiological capacity is only one of the factors that determines overall performance capability. Physiological assessments are an indirect measure of actual performance capability and it was determined that a physiological assessment should identify at least 80% of individuals who demonstrate unsuccessful task performance for it to be valid. It is the author's opinion that physiological assessments that can predict 80% of individuals with inadequate performance capability are an effective measure.

#### *5.6.1 Equipment and assessment protocols*

Physiological assessment equipment and protocols are contained in Appendix D.

### **5.7 Results**

Statistical analysis of data was performed using Microsoft Excel 97 and discriminant analysis was performed using SPSS for Windows V9.0. Discriminant analysis was performed to predict group membership based on the physiological test result. Results are expressed as group mean (unless where indicated)  $\pm$  standard deviation.

Correlations are by Pearson's Product Moment Coefficient ( $r$ ).

**Table 5.1 Physical characteristics of subjects**

<i>n</i>	Age (yrs)	Height (cm)	Weight (kg)	BMI
73 (41 males, 32 females)	26.1 $\pm$ 6.95	173.1 $\pm$ 9.34	74.8 $\pm$ 13.97	24.9 $\pm$ 3.4

### 5.7.1 Handgrip strength test

The results indicate that the handgrip strength test is effective in identifying individuals who cannot successfully perform firearms training, baton training and weaponless control training.

#### 5.7.1.1 Firearms training

16 students displayed problems with firearms training and their mean combined handgrip (left + right) was 65.4 kg  $\pm$  12.1. The combined handgrip strength correctly identified 93.8% of those who had problems. The mean right handgrip result for those students who displayed problems was 33.9 kg  $\pm$  6.7, which correctly identified 93.8% of students with problems. The mean left handgrip result for those students who had problems was 31.5 kg  $\pm$  5.7, which correctly identified 93.8% of students with problems (Table 5.3).

56 students displayed no problems with firearms training and their mean combined handgrip result was 97.4 kg  $\pm$  21.5. The combined handgrip strength correctly identified 75.0% of those who had no problems. The mean right handgrip result for those students who did not display problems was 49.7 kg  $\pm$  11.0, which correctly identified 71.4% of students with no problems. The mean left handgrip result for those students who did not display problems was 47.7 kg  $\pm$  11.0, which correctly identified 75.0% of students with no problems (Table 5.4).

**Table 5.2 Summary results for the physiological assessment of policing students.**

This table shows the group mean and range of scores for each of the physiological assessments performed.

	<i>n</i>	Mean $\pm$ SD	Range	
			Min	Max
<b>Sum of 7 Skinfolds (mm)</b>	73	116.4 $\pm$ 34.8	40.8	191.6
<b>Sum of 7 Skinfolds – male (mm)</b>	41	104.3 $\pm$ 30.9	40.8	160.2
<b>Sum of 7 Skinfolds – female (mm)</b>	32	132.0 $\pm$ 33.6	53.1	191.6
<b>Handgrip strength right hand (kg)</b>	73	46 $\pm$ 12.11	25	76
<b>Handgrip strength left hand (kg)</b>	73	43.9 $\pm$ 12.1	20	72
<b>Handgrip strength combined (kg)</b>	73	89.9 $\pm$ 23.9	45	146
<b>Vertical jump (cm)</b>	73	40.0 $\pm$ 9.8	17	71
<b>Abdominal strength (level)</b>	73	3.2 $\pm$ 1.8	0	6
<b>Push ups (reps) 25 maximum</b>	73	18.2 $\pm$ 9.4	0	25
<b>Agility (sec)</b>	71	17.72 $\pm$ 1.58	15.31	22.21
<b>40 metre sprint (sec)</b>	67	6.37 $\pm$ 0.76	5.11	8.63
<b>Multi-stage fitness (Level)</b>	72	8.4 $\pm$ 2.1	3.1	13.1
<b>Pred VO<sub>2</sub>max (ml/kg/min)</b>	72	41.3 $\pm$ 7.3	22.0	57.3



**Table 5.3 Discriminant analysis results for students who demonstrated problems with operational skills training tasks.**

The results show the physiological assessment mean of the students who demonstrated problems with a training task and also the percentage of these individuals who were correctly identified based on their physiological assessment result. \* Indicates that the physiological assessment is effective in predicting unsuccessful task performance (>80%).

<b>Operational skills training task</b>	<b>Number with problems performing training task</b>	<b>Physiological assessment</b>	<b>Mean <math>\pm</math>SD</b>	<b>% correctly classified based on physiological assessment result</b>
Firearms training	16	Combined handgrip (kg)	65.4 $\pm$ 12.1	93.8*
Firearms training	16	Right handgrip (kg)	33.9 $\pm$ 6.7	93.8*
Firearms training	16	Left handgrip (kg)	31.5 $\pm$ 5.7	93.8*
Firearms training	16	Push-ups (reps)	9.3 $\pm$ 9.3	68.8
Kicks/knee strikes	12	Vertical jump (cm)	27.2 $\pm$ 5.4	91.7*
Batons training	15	Combined handgrip (kg)	65.3 $\pm$ 12.6	93.3*
Batons training	15	Right handgrip (kg)	33.8 $\pm$ 7.0	93.3*
Batons training	15	Left handgrip (kg)	31.5 $\pm$ 5.8	93.3*
Batons training	15	Push-ups (reps)	8.5 $\pm$ 8.5	73.3
Baton training	15	Skinfolds (mm)	141.2 $\pm$ 29.7	66.7
Weaponless control	15	Push-ups (reps)	6.7 $\pm$ 8.5	80.0*
Weaponless control	15	Combined handgrip (kg)	68.0 $\pm$ 12.2	93.3*
Weaponless control	15	Right handgrip (kg)	35.3 $\pm$ 6.4	93.3*
Weaponless control	15	Left handgrip (kg)	32.7 $\pm$ 6.0	86.7*
Weaponless control	15	Vertical jump (cm)	28.5 $\pm$ 5.7	86.7*
Weaponless control	15	Abdominal strength (level)	2.5 $\pm$ 2.0	40.0
Weaponless control	15	Skinfolds (mm)	149.2 $\pm$ 28.2	73.3
Public order policing	6	40 Metre sprint (seconds)	7.94 $\pm$ 0.59	83.3*
Public order policing	6	Agility (seconds)	20.67 $\pm$ 1.58	83.3*
Public order policing	6	Vertical jump (cm)	25.2 $\pm$ 6.0	100*
Public order policing	6	Skinfolds (mm)	160.3 $\pm$ 15.7	100*

**Table 5.4 Discriminant analysis results for students who did not demonstrate problems with operational skills training tasks.**

The results show the physiological assessment mean of the students who did not demonstrate problems with a training task and also the percentage of these individuals who were correctly identified based on their physiological assessment result. \* Indicates that the physiological assessment is effective in predicting successful task performance (>80%).

Operational skills training task	Number without problems performing training task	Physiological assessment	Mean $\pm$ SD	% correctly classified based on physiological assessment result
Firearms training	56	Combined handgrip (kg)	97.4 $\pm$ 21.5	75.0
Firearms training	56	Right handgrip (kg)	49.7 $\pm$ 11.0	71.4
Firearms training	56	Left handgrip (kg)	47.7 $\pm$ 11.0	75.0
Firearms training	56	Push-ups (reps)	20.6 $\pm$ 7.9	82.1*
Kicks/knee strikes	58	Vertical jump (cm)	42.7 $\pm$ 8.4	86.2*
Batons training	57	Combined handgrip (kg)	96.8 $\pm$ 21.7	73.7
Batons training	57	Right handgrip (kg)	49.4 $\pm$ 11.0	70.2
Batons training	57	Left handgrip (kg)	47.4 $\pm$ 11.1	73.7
Batons training	57	Push-ups (reps)	20.6 $\pm$ 8.0	82.5*
Baton training	57	Skinfolds (mm)	110.2 $\pm$ 33.5	66.7
Weaponless control	55	Push-up test (reps)	21.2 $\pm$ 7.1	85.5*
Weaponless control	55	Combined handgrip (kg)	97.3 $\pm$ 22.1	74.3
Weaponless control	55	Right handgrip (kg)	49.7 $\pm$ 11.4	70.9
Weaponless control	55	Left handgrip (kg)	47.7 $\pm$ 11.2	74.5
Weaponless control	55	Vertical jump (kg)	43.2 $\pm$ 8.2	81.8*
Weaponless control	55	Abdominal strength (level)	3.4 $\pm$ 1.7	67.3
Weaponless control	55	Skinfolds (mm)	108.8 $\pm$ 33.8	74.5
Public order policing	60	40 Metre sprint (seconds)	6.20 $\pm$ 0.57	93.3*
Public order policing	64	Agility (seconds)	17.42 $\pm$ 1.29	85.9*
Public order policing	66	Vertical jump (cm)	41.5 $\pm$ 8.9	80.3*
Public order policing	65	Skinfolds (mm)	112.7 $\pm$ 33.5	81.8*

#### 5.7.1.2 Baton Training

15 students displayed problems with baton training and their mean combined handgrip result was  $65.3 \text{ kg} \pm 12.6$ . The combined handgrip strength test correctly identified 93.3% of those who displayed problems. The mean right handgrip result for those students who had problems was  $33.8 \text{ kg} \pm 7.0$ , which correctly identified 93.3% of students with problems. The mean left handgrip result for those students who had problems was  $31.5 \text{ kg} \pm 5.8$ , which correctly identified 93.3% of students with problems (Table 5.3).

57 students displayed no problems with baton training and their mean combined handgrip result was  $96.8 \text{ kg} \pm 21.7$ . The combined handgrip strength test correctly identified 73.7% of those who displayed no problems. The mean right handgrip result for those students who did not display problems was  $49.4 \text{ kg} \pm 11.0$ , which correctly identified 70.2% of students with no problems. The mean left handgrip result for those students who did not display problems was  $47.4 \text{ kg} \pm 11.1$ , which correctly identified 73.7% of students with no problems (Table 5.4).

#### 5.7.1.3 Weaponless Control

15 students displayed problems with weaponless control training and their mean combined handgrip result was  $68.0 \text{ kg} \pm 12.2$ . The combined handgrip strength test correctly identified 93.3% of those who displayed problems. The mean right handgrip result for those students who had problems was  $35.3 \text{ kg} \pm 6.4$ , which correctly identified 93.3% of students with problems. The mean left handgrip result for those students who had problems was  $32.7 \text{ kg} \pm 6.0$ , which correctly identified 86.7% of students with problems (Table 5.3).

55 students displayed no problems with weaponless control training and their mean combined handgrip result was 97.3 kg  $\pm$ 22.1. The combined handgrip strength test correctly identified 74.3% of those who displayed no problems. The mean right handgrip result for those students who did not display problems was 49.7 kg  $\pm$ 11.4, which correctly identified 70.9% of students with no problems. The mean left handgrip result for those students who did not display problems was 47.7 kg  $\pm$ 11.2, which correctly identified 74.5% of students with no problems (Table 5.4).

### *5.7.2 Push-up test*

The results indicate that the push-up test is effective in identifying individuals who cannot successfully perform weaponless control training and baton training.

#### 5.7.2.1 Weaponless Control

15 students displayed problems with weaponless control training and their mean push-up result was 6.7 repetitions  $\pm$ 8.5. The push-up test correctly identified 80.0% of those who displayed problems (Table 5.3).

55 students displayed no problems with weaponless control training and their mean push-up test result was 21.2 repetitions  $\pm$ 7.1. The push-up test correctly identified 85.5% of those who displayed no problems (Table 5.4).

#### 5.7.2.2 Baton Training

15 students displayed problems with baton training and their mean push-up test result was 8.5 repetitions  $\pm$ 8.5. The push-up result correctly identified 73.3% of those who displayed problems (Table 5.3).

57 students displayed no problems with baton training and their mean push-up test result was 20.6 repetitions  $\pm 8.0$ . The push-up test correctly identified 82.5% of those who displayed no problems with baton training (Table 5.4).

#### 5.7.2.3 Firearms Training

16 students displayed problems with firearms training and their mean push-up test result was 9.3 repetitions  $\pm 9.3$ . The push-up test correctly identified 68.8% of those who displayed problems with firearms training (Table 5.3).

56 students displayed no problems with firearms training and their mean push-up result was 20.6 repetitions  $\pm 7.9$ . The push-up result correctly identified 82.1% of those who displayed no problems with firearms training (Table 5.4).

### *5.7.3 Vertical jump test*

The results indicate that the vertical jump test is effective in identifying individuals who cannot successfully perform self-defence training (kicks/knee strikes), weaponless control and public order policing. Additionally, the vertical jump test results showed a significant correlation with the 40-metre sprint test ( $r = -0.847$ ,  $p < 0.01$ ), and agility test ( $r = -0.771$ ,  $p < 0.01$ ) (Table 5.5).

#### 5.7.3.1 Kicks/knee strikes

12 students displayed problems with kicks and knee strikes (self-defence training) and their mean vertical jump result was 27.2 cm  $\pm 5.4$ . The vertical jump result correctly identified 91.7% of those who displayed problems with kick and knee strike training (Table 5.3).

58 students displayed no problems with kicks and knee strikes and their mean vertical jump result was 42.7 cm  $\pm 8.4$ . The vertical jump result correctly

identified 86.2% of those who displayed no problems with kick and knee strike training (Table 5.4).

#### 5.7.3.2 Weaponless Control

15 students displayed problems with weaponless control training and their mean vertical jump result was 28.5 cm  $\pm$ 5.7. The vertical jump result correctly identified 86.7% of those who displayed problems with weaponless control training (Table 5.3).

55 students displayed no problems with weaponless control training and their mean vertical jump result was 43.2 cm  $\pm$ 8.2. The vertical jump result correctly identified 81.8% of those who displayed no problems with weaponless control training (Table 5.4).

#### 5.7.3.3 Public Order Policing

6 students displayed problems with public order policing training and their mean vertical jump result was 25.2 cm  $\pm$ 6.0. The vertical jump result correctly identified 100% of those who displayed problems with public order policing training (Table 5.3).

66 students displayed no problems with public order policing training and their mean vertical jump result was 41.5 cm  $\pm$ 8.9. The vertical jump result correctly identified 80.3% of those who displayed no problems with public order policing training (Table 5.4).

**Table 5.5 Physiological assessment correlations.**

This table shows the correlation between some of the physiological assessments.

Gender	Variable 1	Variable 2	Correlation
M	Skinfolds	Multi-stage fitness	-0.642*
F	Skinfolds	Multi-stage fitness	-0.589*
M & F	Skinfolds	Multi-stage fitness	-0.677*
M	Skinfolds	40 metre sprint	0.307*
F	Skinfolds	40 metre sprint	0.496*
M & F	Skinfolds	40 metre sprint	0.528*
M	Skinfolds	Agility	0.269*
F	Skinfolds	Agility	0.514*
M & F	Skinfolds	Agility	0.527*
M & F	Skinfolds	Body Mass Index	0.531*
M	Skinfolds	Waist measurement	0.386*
F	Skinfolds	Waist measurement	0.688*
M & F	Vertical jump	40 metre sprint	-0.847*
M & F	Vertical jump	Agility	-0.771*
M & F	40 metre sprint	Agility	0.916*

\*Significant at the 0.01 level (2 tailed).

#### 5.7.4 7 Stage abdominal strength test

The results indicate that the 7-stage abdominal strength test has only a moderate ability to correctly identify individuals who cannot successfully perform weaponless control training but has a better ability to identify individuals who do not have problems.

##### 5.7.4.1 Weaponless Control

15 students displayed problems with weaponless control training and their mean abdominal strength result was level  $2.5 \pm 2.0$ . The abdominal strength result

correctly identified 40.0% of those who displayed problems with weaponless control training (Table 5.3).

55 students displayed no problems with weaponless control training and their mean abdominal strength result was level  $3.4 \pm 1.7$ . The abdominal strength result correctly identified 67.3% of those who displayed no problems with weaponless control training (Table 5.4).

#### 5.7.5 Agility test

The results indicate that the agility test is effective in identifying individuals who cannot successfully perform public order policing training. Additionally, the agility test results showed a significant correlation with the 40-metre sprint test ( $r=0.916$ ,  $p<0.01$ ), vertical jump test ( $r=-0.771$ ,  $p<0.01$ ), and the sum of skinfolds ( $r=0.527$ ,  $p<0.01$ ).

##### 5.7.5.1 Public Order Policing

6 students displayed problems with public order policing training and their mean agility result was 20.67 seconds  $\pm 1.58$ . The agility result correctly identified 83.3% of those who displayed problems with public order policing training (Table 5.3).

64 students displayed no problems with public order policing training and their mean agility result was 17.42 seconds  $\pm 1.29$ . The agility jump result correctly identified 85.9% of those who displayed no problems with public order policing training (Table 5.4).

#### 5.7.6 40 Metre sprint test

The results indicate that the 40 metre sprint test is effective in identifying individuals who cannot successfully perform public order policing training. Additionally, the 40



metre sprint test results showed a significant correlation with the vertical jump test ( $r=-0.847$ ,  $p<0.01$ ), agility test ( $r=0.916$ ,  $p<0.01$ ), and the sum of skinfolds ( $r=0.528$ ,  $p<0.01$ ).

#### 5.7.6.1 Public Order Policing

6 students displayed problems with public order policing training. The mean 40-metre sprint result was 7.94 seconds  $\pm 0.59$ . The agility result correctly identified 83.3% of those who displayed problems with public order policing training (Table 5.3).

60 students displayed no problems with public order policing training. The mean 40 metre sprint result was 6.20 seconds  $\pm 0.57$ . The 40-metre sprint result correctly identified 93.3% of those who displayed no problems with public order policing training (Table 5.4).

#### *5.7.7 Multi-stage fitness test*

The multi-stage fitness test results showed a significant correlation with the sum of skinfolds assessment ( $r=-0.677$ ,  $p<0.01$ ).

#### *5.7.8 Skinfold measurements*

The results indicate that the sum of skinfolds measurement is effective in identifying individuals who cannot successfully perform public order policing training.

Additionally, the skinfold results showed a significant correlation with the 40 metre sprint test ( $r=0.528$ ,  $p<0.01$ ), the agility test ( $r=0.527$ ,  $p<0.01$ ), waist measurement, Body Mass Index ( $r=0.531$ ,  $p<0.01$ ), and the multi-stage fitness test ( $r=-0.677$ ,  $p<0.01$ ).

#### 5.7.8.1 Public Order Policing

6 students displayed problems with public order policing training and their mean sum of skinfolds result was 160.3 mm  $\pm$ 15.7. The sum of skinfolds result correctly identified 100% of those who displayed problems with public order policing training (Table 5.3).

65 students displayed no problems with public order policing training and their mean sum of skinfolds result was 112.7 mm  $\pm$ 33.5. The sum of skinfolds measurement result correctly identified 81.8% of those who displayed no problems with public order policing training (Table 5.4).

#### 5.7.8.2 Weaponless Control

15 students displayed problems with weaponless control training and their mean sum of skinfolds result was 149.2 mm  $\pm$ 28.2. The sum of skinfolds result correctly identified 73.3% of those who displayed problems with weaponless control training (Table 5.3).

55 students displayed no problems with weaponless control training and their mean sum of skinfolds result was 108.8 mm  $\pm$ 33.8. The sum of skinfolds result correctly identified 74.5% of those who displayed no problems with weaponless control training (Table 5.4).

#### 5.7.8.3 Baton Training

15 students displayed problems with baton training and their mean sum of skinfolds result was 141.2 mm  $\pm$ 29.7. The sum of skinfolds result correctly identified 66.7% of those who displayed problems with baton training (Table 5.3).

57 students displayed no problems with baton training and their mean sum of skinfolds result was 110.2 mm  $\pm$ 33.5. The sum of skinfolds result correctly identified 66.7% of those who displayed no problems with baton training (Table 5.4).

## **5.8 Discussion**

As identified in Chapter 4, forearm and handgrip strength is an important physiological component of a number of essential policing tasks including effective use of the Glock 22 pistol, restraining/handcuffing of non-compliant persons, and the application of effective self-defence. The results of the discriminant analysis indicate that the handgrip strength test is effective in predicting unsuccessful task performance in firearms training, baton training and weaponless control training.

Upper body strength was identified as being an important physiological component of restraining/handcuffing of non-compliant persons, applying effective self-defence and moving objects or persons. The push-up test is an assessment of general upper body strength and the results of the discriminant analysis indicate that this test is effective in predicting unsuccessful task performance in weaponless control training.

Lower limb strength/power was identified as being an important component of a number of essential policing tasks including: running short/moderate distances, applying effective self-defence, moving objects or persons, and jumping onto, over or down from an obstacle. The vertical jump test assesses lower limb strength/power and the results of the discriminant analysis indicate that this test is effective in predicting unsuccessful performance in self-defence training (kicks/knee strikes), weaponless control and public order policing. As expected, lower limb strength/power was correlated with

performance in the 40 metre sprint test ( $r=-0.847$ ,  $p<0.01$ ), and agility test ( $r=-0.771$ ,  $p<0.01$ ).

Torso strength/stability is essential in the performance of activities such as restraining non-compliant persons and applying effective self-defence. Additionally, torso strength/stability is vital for a variety of other manual handling tasks and also in the maintenance of correct posture to avoid back injury and back pain. Weak abdominal musculature allows the abdomen to drop creating a greater load on the lower back and forcing it to support the mass in front of it. Strengthening the abdominals creates greater intra-abdominal pressure; increased pressure forces a more upright positioning of the spine. The net result is a decreased load on the lumbar discs. Increasing the strength of the lumbar extensors and the abdominals will improve posture and may decrease the incidence of back pain. Strong lower back muscles and strong abdominals work together to maintain a pain free healthy back.

The 7-stage abdominal strength test revealed only a moderate ability to identify poor performers in weaponless control training but a better ability to identify high performers. However, the assessment of abdominal strength is useful from a recruit training perspective to identify individuals who may have an increased risk of lower back pain/injury and to provide these individuals with a specific remedial intervention program.

Agility was identified as being an important component of essential policing duties including sprinting a short distance and engaging in crowd control (public order policing). Public order policing training involves teaching students how to conduct crowd control as a group. This involves being able to relocate quickly as a group into the position required. These data indicate that the agility test is an effective means of

identifying individuals who cannot successfully perform public order policing training. Additionally, the agility test results demonstrate a significant correlation with the 40-metre sprint test ( $r=0.916$ ,  $p<0.01$ ), vertical jump test ( $r=-0.771$ ,  $p<0.01$ ), and the sum of skinfolds measurement ( $r=0.527$ ,  $p<0.01$ ).

The ability to sprint short distances is essential for performing operational policing duties effectively and efficiently. The results indicate that the 40 metre sprint test is effective in predicting which individuals will have a poor ability to maintain speed with the majority of the group during public order policing training. Additionally, the 40 metre sprint test results demonstrate a significant correlation with the vertical jump test ( $r=-0.847$ ,  $p<0.01$ ), agility test ( $r=0.916$ ,  $p<0.01$ ), and the sum of skinfolds ( $r=0.528$ ,  $p<0.01$ ).

Aerobic fitness is a component of a number of operational policing tasks. Endurance fatigue resulting from a lack of aerobic power may impact on the performance of policing tasks. Furthermore, reduced aerobic power was significantly correlated with sum of skinfolds measurement ( $r=-0.677$ ,  $p<0.01$ ).

The sum of skinfolds measurement effectively predicts which individuals will not successfully perform public order policing training. Furthermore, the agility test results demonstrate a significant correlation with the 40 metre sprint test ( $r=0.528$ ,  $p<0.01$ ), the agility test ( $r=0.527$ ,  $p<0.01$ ), Body Mass Index ( $r=0.531$ ,  $p<0.01$ ), and the multi-stage fitness test ( $r=-0.677$ ,  $p<0.01$ ).

In summary, these results indicate that the handgrip strength test, push-up test, vertical jump test, agility test, 40 metre sprint test, multi-stage fitness test and skinfolds

measurement are a valid means of identifying students who will demonstrate ineffective performance capability during operational skills training. The abdominal strength test did not adequately predict performance capability. The 40 metre sprint and the Illinois Agility Test demonstrated a strong correlation ( $r=0.916$ ,  $p<0.01$ ). Based on this correlation it is the author's recommendation that only the 40-metre sprint need be included as one of the physiological assessments.

It is beyond the immediate scope of this thesis to identify minimum standards for employment. However, the data obtained can be used in conjunction with further research to help establish minimum levels of physiological assessment performance as related to the effective performance of operational policing tasks.

Age and gender standards are not acceptable according to Anti-discrimination legislation. Standards should be job related and based on the principle of 'same job = same standard'. Consequently, any age or gender standards are in conflict of this law with the only exception being skinfold measurements. With body fat, different criterion levels should be established for males and females. Females are predisposed to carrying a greater amount of body fat, yet it is important to realise that at the same level, the health/injury risks associated are not as great as for the male population.

It is very difficult to justify the setting of an exact cut-off point for skinfolds. At employment stage, if a recruit applicant is identified as having 'elevated' but not 'excessive' skinfold measurements, it is recommended that the applicant be employed on the condition that they undergo remedial programming post employment. Recruit applicants who have 'excessive' skinfold measurements should be advised to reduce body fat levels prior to reapplying for employment.

It is recommended that obstacle negotiation (fences, small walls etc.) be included in the operational skills training curriculum. Once this occurs, further research should be conducted to determine the effectiveness of the vertical jump test in predicting the ability to jump up, onto or down from an obstacle.

One of the shortcomings of this study was an inability to determine the level of aerobic capacity required for operational policing. Although a moderate level of aerobic capacity is required, it is somewhat difficult to determine the level required for effective and efficient performance of operational duties. Many variables need to be considered including: aerobic content of tasks, aerobic reserve required for recovery and performance of consecutive tasks, aerobic fitness required for management of healthy body fat levels, aerobic fitness for cardiovascular health, and the prevention of endurance fatigue which may impact on performance of critical tasks.

## **CHAPTER 6: EFFECTIVENESS OF A TARGETED REMEDIAL INTERVENTION PROGRAM**

### **6.1 Introduction**

A successful pre-employment physical assessment program should be able to accurately identify weaknesses in physical performance capacity. Under the proposed physiological assessment program, potential recruits can be tested upon course entry and be provided with health lifestyle education and targeted remedial intervention. This will help ensure that candidates with less than adequate physical performance capacity obtain at least a minimum standard required prior to applying for police employment.

Physiological assessments can provide accurate feedback on the underlying components required for effective task performance. Obstacle-based testing lacks the ability to provide accurate information; hence remedial advice can not be provided with confidence.

The physiological changes that occur as a result of physical training have been well researched and documented. For many years sports scientists have applied physiological tests to elite athletes to help formulate specific remedial intervention programs to improve sports performance (Gore *et al.*, 1998). The purpose of this part of the study was to determine if the proposed functional capacity assessment program is effective in identifying weaknesses in performance capacity and therefore the application of a remedial intervention program results in increased physiological performance.



## 6.2 Methods

Students were familiarised with each of the physiological assessments prior to the initial testing session. 232 graduate entry Diploma in Policing Practice students were physiologically assessed with each of the assessments before and after 14 weeks of remedial intervention. The intervention consisted of both theory-based education and physical training that was delivered by both tertiary and 'Fitness Leader' qualified Physical Training Instructors.

## 6.3 Results

Results are expressed as group mean  $\pm$  standard deviation. Statistical analysis of data was performed using Microsoft Excel Version 97. Results are expressed as group mean (unless where indicated)  $\pm$  standard deviation. The t-Test performed was a paired t-Test.

**Table 6.1 Physical characteristics of subjects**

<i>n</i>	Age (yr)	Height (cm)	Weight (kg)	BMI
232 (128 males, 104 females)	26.7 $\pm$ 5.87	172.4 $\pm$ 9.28	75.2 $\pm$ 13.68	25.1 $\pm$ 3.4

The results indicate that physiological capacity increases significantly when potential recruits receive health education and 14 weeks of remedial exercise programming (Table 6.2).

**Table 6.2 Physiological assessment results of policing students before and after 14 weeks of remedial intervention.**

These data indicate that 14 weeks of remedial intervention results in a significant increase in physiological performance capacity.

	<i>n</i>	Pre-intervention			Post-intervention			Group Mean change
		Mean	Range		Mean	Range		
		± SD	Min	Max	± SD	Min	Max	
Handgrip strength right hand (kg)	231	45.67 ± 11.79	22	74	48.24 ± 11.86	27	74	2.58*
Handgrip strength left hand (kg)	231	43.45 ± 12.13	20	69	45.82 ± 11.79	24	72	2.38*
Handgrip strength combined (kg)	231	89.12 ± 23.52	42	140	94.06 ± 23.23	53	144	4.95*
Vertical jump (cm)	228	39.74 ± 10.74	10	66	44.29 ± 8.28	30	67	4.54*
Abdominal strength (level)	230	2.53 ± 1.58	0	6	3.61 ± 1.28	1	7	1.08*
Push ups (reps)  25 maximum	228	18.66 ± 8.35	0	25	23.89 ± 3.20	7	25	5.23*
Agility (sec)	223	17.94 ± 1.42	15.15	22.40	17.07 ± 1.07	15.03	20.36	-0.87*
40 metre sprint (sec)	220	6.38 ± 0.72	5.18	8.51	6.10 ± 0.63	4.99	7.80	-0.28*
Multi-stage fitness (level)	222	7.78 ± 2.21	3.1	12.5	9.07 ± 1.85	5.1	15.2	1.29*

\* Significant at the 0.01 level (2 tailed).

## **6.4 Discussion**

The results indicate that physiological capacity increases significantly when potential recruits undergo physiological assessment at course entry and receive health education and 14 weeks of remedial programming prior to reassessment. It is well accepted that undertaking a physical training program results in increased physiological performance capacity.

The success of the proposed physical assessment program is reliant upon a structured and effective remedial intervention program. An important aim of the physiological assessment is to identify specific weaknesses in performance capacity and to apply an individualised remedial intervention program. The relative strengths and weaknesses of each individual will determine the most effective form of training. The utilisation of best practice training methods helps to ensure that maximal results are achieved from the training undertaken.

The focus of the proposed pre-employment physical assessment program must be on the physical training and not on the physiological assessments. The physiological assessments are only to ensure that recruit applicants possess at least the minimum physiological capacity required for successful performance of tasks. The physical training which students undertake should be designed to elicit a training response well above any identified minimum standard.

## **CHAPTER 7: GENERAL DISCUSSION**

The general aim of this study was to develop a pre-employment functional capacity assessment program that is scientifically valid and also able to identify specific weaknesses in performance capacity, which allows for targeted remedial intervention.

**The first hypothesis of this study proposed that the identification and analysis of essential policing tasks will allow a determination of the underlying physiological demands required for successful task performance.** Determining the physical requirements of performing general duties policing is the first step towards developing appropriate and valid procedures for pre-employment physical assessment. This study identified essential policing tasks and the subsequent analysis of these tasks provided a determination of the underlying physiological components required for successful task performance.

**The second hypothesis of this study stated that the application of selected physiological assessments will provide an accurate determination of the functional capacity required for successful task performance and subsequently be capable of predicting ineffective performance of essential policing tasks.** The results of this study indicate that the selected assessments are effective in predicting unsuccessful performance of essential policing tasks. The exception is the abdominal strength test. However, it may be useful from a training perspective for the identification and remedial programming of individuals who may have an increased risk to the development of lower back injury. Due to the reported high incidence of strains, sprains and back injuries resulting from lifting and carrying tasks (NSW Police Service – Occupational Health & Safety Section, 1999), it is recommended that education in

correct manual handling procedures are incorporated into the recruit training curriculum.

The Police Service must remain up to date with best practice physiological assessments. If an improved method of assessing a component of physiological capacity is developed and scientifically validated, then this newly developed test should supersede the current test after determining that it is genuinely job-related through research.

**The third hypotheses of this study stated that a pre-employment physical assessment program that correctly identifies specific weaknesses in performance capacity will provide the opportunity for education and remedial intervention which when applied will result in significant increases in the physical capacity of recruit applicants.** After 14 weeks of intervention a significant increase in physiological capacity was demonstrated. Standard entry into the Diploma in Policing course allows students 12 months of physical training prior to employment stage. This period of time should be more than adequate for individuals to achieve minimum standards providing that they undertake an appropriate physical training program. It is important that graduate entry students have a higher physiological capacity prior to course entry as they only have 14 weeks prior to applying for police service employment.

The focus of the proposed pre-employment physical assessment program should be targeted towards the physical training and not the physical assessment. The physical training which course participants undertake should be designed to elicit a training response well above any minimum set standards. The physiological assessments are only to ensure that recruit applicants possess at least the minimum physiological capacity required for successful performance of tasks.

Physiological assessments as opposed to obstacle courses allow for accurate determination of weaknesses in performance capacity. Therefore, a major advantage of the proposed assessment program is that specific remedial programming advice can be provided with confidence. Hence, the individual can undertake a tailored training program and after a period of time, the minimum standard can be achieved. Obviously if initial capability is very poor, then it may take longer for some individuals to reach the required standard. It is recommended that policing students have the opportunity to participate in the physical assessment at least three times during their Academy training. They should be tested at course entry, during the course, and prior to employment, to provide a formative evaluation of their physical training.

It is important to note that the purpose of this newly developed physical assessment program is not to provide students with skill-based assessment (like the outdated obstacle based test). Rather it aims to ensure that students possess the underlying physiological capacity to successfully perform the physical component of policing. Any skill-based training and assessment should be encompassed within the operational skills training component.

Although education and remedial intervention is a component of this pre-employment program, a base level of physical capacity is highly desirable prior to course entry. An assessment of aerobic fitness (multi-stage fitness test) could be conducted prior to course entry to ensure that students possess at least a base level of cardiorespiratory endurance capacity. Additionally, prospective policing students should be given information explaining the importance of physical fitness in relation to operational policing and advised to seek advice from a qualified fitness professional regarding the

development of forearm/handgrip strength, upper body strength, torso strength/stability, lower limb strength/power, short sprint ability and aerobic fitness.

A Body Mass Index (BMI) calculation and waist measurement could be incorporated into the pre-course applicant medical to aid in early identification of excessive fatness. Individuals who have a BMI which corresponds to a level classified as obese ( $\geq 30$ : World Health Organisation, 1998) combined with an excessive waist measurement ( $\geq 102$  for males,  $\geq 88$  for females: World Health Organisation) should be advised to consult an accredited Dietitian in their local area prior to course entry. Accredited Practising Dietitians (APD) are members of the Dietitians Association of Australia (DAA) and are recognised professionals who have the qualifications and expertise to provide expert nutrition and dietary advice. Other policing course applicants who believe their body fat is elevated should also be encouraged to seek professional advice prior to entering the policing course.

With these proposed changes to pre-employment physical assessment, physical ability can now be made a training issue and not just an exclusion factor for acceptance into training. The previous system placed the onus on applicants to present themselves in suitable condition to pass the obstacle course prior to being accepted for training. Those individuals failing to reach the required level for employment would be turned away. It is reasonable to assume that some of these individuals had the potential to adequately pass the test, but failed due to reduced functional fitness and incorrect training methods. These individuals also failed to identify specific weaknesses in components of their physical performance and therefore did not have the opportunity to remediate any downfalls in performance. Potential recruits can now be selected for entry into training based on prior learning and employment experience and then be given the necessary

physical training to ensure that they will be able to perform operational duties effectively and efficiently.

Further research needs to be undertaken to determine how often injuries or unsuccessful task performance results from inadequate fitness, as opposed to improper application of techniques, or factors beyond the officer's control. Additionally, further research needs to be carried out to investigate the level of aerobic capacity required for operational policing.



## **CHAPTER 8: CONCLUSIONS AND RECOMMENDATIONS**

This research project has developed and evaluated a pre-employment functional capacity assessment program that is scientifically valid, therefore reducing the risk of litigation. Furthermore, the proposed functional capacity assessment program allows for education and remedial intervention of recruit candidates with less than adequate physical performance capability.

1. This study has revealed that identified physiological assessments effectively predict performance in essential operational policing tasks.
2. This study revealed that a pre-employment functional capacity assessment program that provides education and remedial intervention helps ensure significant increases in the physical capacity of recruit applicants.
3. The proposed pre-employment functional capacity assessment program would help to ensure that efficient and effective use is made of recruit training funding and therefore serves to maximise the effectiveness of police training resources.

Due to the relationship that has been established between physiological assessment performance and successful policing task performance, it is recommended that further research be conducted to assist with the determination of minimum physiological assessment standards. Once these standards have been established it is recommended that Diploma in Policing Practice students achieve at least the minimum set standard prior to undertaking the operational skills training component.

In the United States there has been considerable litigation regarding law enforcement agency liability based upon an agency's negligence in failing to train and supervise

officers for use of force and firearms operations. That same concept is now being applied to physical fitness. There has been legal action in which a city was found negligent for not having an ongoing fitness program for officers (Parker V Washington, 1988). The police agency was found to be deliberately indifferent to the needs of officers to remain trained.

There has been some criticism within Australian police services of the use of entry standards and their job relatedness if employees are required to conform to a certain standard upon entry to the organisation, but not once employed nor again for the duration of their career. It is apparent that while the average police officer graduates from the police training college in adequate physical condition, the normal sedentary nature of operational policing leads to rapid deterioration in physical fitness. Now that job related functional capacity assessment has been developed, the next step is to determine minimum standards. Once this has been achieved the challenge is for the NSW Police to conduct further research to develop and implement standards for existing officers.

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## **APPENDICES**

## **APPENDIX A: PRE-EMPLOYMENT PHYSICAL ASSESSMENT WITHIN AUSTRALIAN POLICE JURISDICTIONS**

## **South Australia Police**

### **Multi-stage Fitness Test (shuttle run)**

Applicants must reach the standard of 50% as per the Australian fitness norms.

### **Agility Test**

To be completed within 3½ minutes.

1. Start from inside police vehicle
2. Climb over 1 metre mesh fence
3. Climb over 1.5 metre Colourbond fence
4. Climb over 1.83 metre Colourbond fence
5. Climb over 3.0 metre cyclone fence
6. Climb over 1.0 metre barbed wire fence
7. Crawl through hole
8. Leap over a 1.5 metre ditch
9. Run through a simulated car park
10. Climb over two 1.0 metre hurdles
11. Climb through a window
12. Drag a weighted object (spare wheel) 20 metres
13. Run 120 metres
14. Remove a tyre from the boot of the police vehicle and put it down. Lift another tyre and carry it back to the boot of the police vehicle and place it inside the boot.

### **Other Requirements**

The applicant must undergo skinfold testing (males <20% body fat, females < 30% body fat). Applicants should also be within a desirable height/weight ratio (BMI).

## Northern Territory Police

### **Physical Abilities Test (PAT)**

To be completed within 2 minutes for males and 2 minutes 40 seconds for females.

1. 2 handed hurdle, 1metre fence
2. 40 metre run
3. 90 degree turn
4. 14 metre run
5. Cross 1.8 metre fence
6. 25 metre run
7. Push twin cab utility 10 metres
8. 19 metre run
9. 10 metre dummy drag (48 kg)
10. 16 metre run
11. 10 metre carry bag (23 kg)
12. 48.5 metre run
13. Window 1 metre high, 68cm wide
14. 32 metre run
15. 1.5 metre wide leap
16. 14.5 metre run
17. Agility hurdles – 4 hurdles, 3.1 metres in length, 2 metres apart
18. 32.5 metre run
19. Crawl through 2.5 metre and 68 centimetre pipe
20. 39 metre run
21. 4 step low hurdles, 0.5 metres high, 3 metres apart
22. 26 metre run to the finish.

### **Multi-stage Fitness Test (shuttle run)**

Minimum levels required:

AGE	18-29	30-39	40-49
MALE	> Level 9.4	> Level 8.2	> Level 7.2
FEMALE	> Level 6.10	> Level 5.6	> Level 4.9

## Western Australia Police

Each test must be successfully completed in order to continue.

### **Unsupported sit-up**

This test consists of lying on the floor in a sit-up position with knees raised and feet flat on the floor. Arms are crossed over the chest. The participant is then required to sit up, bringing the chin up to the knees and holding that position for three seconds. The feet must remain on the floor throughout the sit-up. Only one sit-up is required and each participant is allowed three attempts to pass.

### **Deadlift**

This test consists of lifting a 75kg barbell from the floor to a stand 70cm above the ground. The bar is gripped shoulder width apart. The feet should be shoulder width apart, keeping the knees bent and back straight. By straightening the legs the barbell is lifted from the floor to a position across the upper thighs, finishing with legs locked, torso upright and back straight. The barbell is then placed on the stand.

### **Multi-stage Fitness Test (shuttle run)**

Minimum levels required:

AGE	19-29	30-39	≥ 40
MALE	> Level 10.1	> Level 9.1	> Level 8.1
FEMALE	> Level 7.1	> Level 6.1	> Level 6.1

### **Obstacle Circuit**

*The applicant is required to successfully complete the first 10 components in the order presented below within a time period of 3 minutes and 35 seconds. The eleventh test is to be completed within 5 minutes of completing the 10 tests of the circuit.*

1. Run 4 x 25 metre sprints
2. Traverse balance beam (5 metres long, 135mm wide)
3. Climb 1.85 metre wall
4. Cross a 1.5 metre gully
5. Lift and carry 2 x 20kg weights 15 metres
6. Climb through window opening 1.2 metres from ground
7. Dodge obstacles
8. Climb through window opening 1.5 metres from ground
9. Scale 2.8 metre cyclone wire fence
10. Drag 75kg weight backwards for 15m while in upright position

11. Lift 75kg dummy into the rear of an open van

### **Other Requirements**

Current Bronze medallion

## Tasmania Police

### **Multi-stage Fitness Test (shuttle run)**

<b>AGE</b>	<b>&lt; 35</b>	<b>&gt; 35</b>
MALE	> Level 9.2	> Level 8.2
FEMALE	> Level 6.6	> Level 6.4

### **Sit and Reach Test**

Male = minimum of -12

Female = minimum of -10

### **Push-up Test**

Male = minimum of 25 repetitions

Female = minimum of 12 repetitions

### **Sit-Ups in one minute**

Male = 35 minimum

Female = 30 minimum

### **Chin-Ups underhand grip**

Male = 4 minimum

Female = 30 second flexed arm hang minimum

### **Handgrip Strength**

Male = minimum 50kg both hands

Female = minimum 30kg both hands

### **Leg and Back Strength (dynamometer)**

Male = minimum 160kg

Female = minimum 95 kg

### **Obstacle Course**

There is no time limit for this test element

1. Climb up and over a 3.6 metre high wooden rung fence
2. Climb 2 metres up a ladder frame and through an imaginary window (0.4metre x 0.7metre) and down the other side
3. Clamber over a 1.6 metre high vaulting box
4. Jump over a 0.95 metre high vaulting horse
5. Walk along a balancing beam (0.1 metre wide x 5 metres long, 0.9 metre above the ground)

## **Victoria Police**

### **Firearm Pre-Selection Criteria**

Adopting a one handed grip the applicant is to dry fire the revolver six consecutive times in double action mode (dry fire means without ammunition).

### **Sit and Reach Test**

Minimum: 0cm

### **Physical Pursuit Course**

Complete two laps of the Academy running track (800m) and as part of the second lap perform the 'agility coordination tests'. This agility course is to be completed within 6 minutes and thirty seconds for both males and females.

1. Platform and hurdles
2. Balance beam
3. Wall
4. Window
5. Maze
6. Chain mesh fence
7. Anatomical dummy drag of 10m (75kgs)
8. Arrest simulator
9. Trigger pull of a safe revolver (six left handed & six right handed)
10. Run to the finish line

### **Swimming**

The swimming component requires that in 90 seconds the applicant swims 50 metres using a life saving stroke (freestyle polo or breaststroke), in swimming attire.



## **Queensland Police Service**

### **Physical Competency Test**

Full course – 630m with an outer track of 320m. This agility course is to be completed in the fastest time possible. The actual time taken to complete the course will be considered when selecting applicants.

1. Complete a lap of the outer track and move to the inner track
2. Negotiate a two rung 0.8 metre timber rail fence
3. Scale a 1.65m paling fence with step up
4. Climb a 1.5 metre solid wall
5. Climb through a window opening 1 metre above ground level
6. Climb through a window opening 1.6 metre above ground level with step up
7. Climb 8 steps on the approach side of a 1.78 metre wall and jump from this level
8. Crawl through a crawling from 6 metres long and 0.6 metre high
9. Climb a 2 metres high chain mesh fence
10. Negotiate a series of eight agility bars to simulate dodging around objects
11. Climb a tree rail pine log fence 1.75 metres high
12. Traverse a low balance beam 5.5 metres long
13. Run and jump off a ramp 0.43 metre high
14. Drag a 50 kg human shaped dummy for 10 metres
15. Climb a 1.4 metre paling fence
16. Cross the finishing line

### **Firearm Handling Test**

The applicant is required to demonstrate a capacity to hold, grip, and squeeze trigger of standard police issue revolver using each hand and then both hands. Live ammunition is not used.

## New Zealand Police

Assessing an applicant's physical ability is completed in two stages:

### **STAGE 1**

#### **Body Mass Index (BMI)**

This is calculated by dividing the body weight by the height in metres squared. A heavier person with a high BMI will not be disadvantaged providing the applicant can carry their weight in the run and exercises.

#### **Run (2.4 km)**

*Male*

<b>2.4 km Run</b>	<b>BMI 19 or below</b>	<b>BMI 20-28</b>	<b>BMI 29 &amp; above</b>
<b>&gt;11min 15sec</b>	0	2	0
<b>10min 15sec–11min 15 sec</b>	0	4	3
<b>&lt; 10 min 15 sec</b>	2	6	6

*Female*

<b>2.4 km Run</b>	<b>BMI 19 or below</b>	<b>BMI 20-28</b>	<b>BMI 29 &amp; above</b>
<b>&gt;12min 15sec</b>	0	2	0
<b>11min 15sec–12min 15 sec</b>	0	4	3
<b>&lt; 11 min 15 sec</b>	2	6	6

#### **Vertical Jump, Push Ups and Grip Strength**

*Male*

<b>Rating</b>	<b>Vertical Jump (cm)</b>	<b>Push-ups</b>	<b>Grip Strength (kg)</b>
<b>3</b>	48 & above	34 & above	120 & above
<b>2</b>	40 – 47	25 – 33	105 – 119
<b>1</b>	32 – 39	16 – 24	90 – 104
<b>0</b>	30 or below	15 or below	89 or below

*Female*

<b>Rating</b>	<b>Vertical Jump (cm)</b>	<b>Push-ups</b>	<b>Grip Strength (kg)</b>
<b>3</b>	40 & above	20 & above	80 & above
<b>2</b>	33 – 39	15 – 19	70 – 79
<b>1</b>	26 – 32	10 – 14	60 – 69
<b>0</b>	25 or below	9 or below	59 or below

#### **OVERALL RATING**

- 11-12 Should be able to successfully complete the Required Fitness Standard Test
- 9-10 Marginal, usually further training is recommended.
- 6-8 Further training is required
- ≤ 5 Extensive training is required

## **STAGE 2 - Required Fitness Standard Test**

### **Physical Competency Test**

The physical competency test has 12 obstacles in a 400m area:

1. Push a trailer 10m
2. Run 200m
3. Carry a wheel assembly 10m
4. Walk 5m along a raised beam
5. Jump a 1m hurdle
6. Jump a 2m hurdle
7. Jump a 2m long jump
8. Complete a 30m agility run
9. Crawl under a hurdle
10. Jump through a window
11. Climb over a 2m wall
12. Drag a 74kg body weight 7.5m
13. Climb over a 2.2m wire fence

### **Grip Related Strength Test**

Applicants are encouraged to achieve their best possible result.

<b>RATINGS</b>	<b>PHYSICAL COMPETENCE TEST (PCT)</b>	<b>GRIP STRENGTH</b>
<b>Categories</b>	<b>Time</b>	<b>Combined Grip Strength (kg)</b>
<b>A</b>	< 1 min 45 sec	125 * above
<b>B</b>	1 min 45 to 2 min	112 – 124
<b>C</b>	2 min 1 sec to 2 min 15 secs	99 – 111
<b>D</b>	2 min 16 secs to 2 min 30 secs	86 – 98
<b>E</b>	2 min 31 secs to 2 min 45 secs	73 – 85
<b>F</b>	2 min 46 secs to 3 min	60 – 72
<b>Below minimum standard</b>	> 3 min	59 or below

Preference is given to applicants who achieve higher ratings.

## APPENDIX B: DIPLOMA OF POLICING PRACTICE – Course Structure

### **Trimester 1 (Internal)**

JST100 Physical Skills & Operational Safety (Start)\*  
JST111 Ethical Dimensions of the Police Role  
JST112 Communication in Policing 1  
JST113 The Criminal Justice System  
JST114 Introduction to Policing (A)

### **Trimester 2 (External with 2 six week field placements)**

JST121 Police and Society  
JST122 Policing as a Profession

### **Trimester 3 (Internal)**

JST100 Physical Skills & Operational Safety (Finish)\*  
JST132 Communications in Policing 2  
JST131 Policing Road Safety, Alcohol & Drugs  
JST130 Society, Law & Practice  
JST140 Assessment Centre  
JST134 Introduction to Policing (B) – graduate entrants only

### **Trimester 4 (Distance Education)**

JST241 Police Service: Station & Field  
JST242 Investigative Processes  
JST243 Policing & Vulnerable Populations

### **Trimester 5 (Distance Education)**

JST251 Critical Assessment of Investigative Practice  
JST252 Intelligence, Crime Analysis & Information Technology

### **Trimester 6 (Distance Education)**

JST261 Police Field Practicum  
JST262 Ethics and Accountability 2

### Graduate Level Entry

Graduate entry students or applicants whose recognised prior learning affords them the academic standing equivalent to that of graduates, receive credit for sessions 1 and 2 and commence studies from Trimester 3. They are, however, required to complete an additional subject, JST134 Introduction to Policing B.

*\* **Physical Skills & Operational Safety:** This subject involves the physical components of the course. All students undertake physical fitness training including health and fitness education and operational skills training. The operational skills training includes weaponless control, use of equipment (batons, handcuffs, oleoresin capsicum spray, firearms etc.), crowd control and operational safety tactics (building search, bomb search, persons and vehicles).*

## **JST 100: Operational Skills Training – Subject outline**

### **Unit overview:**

This unit introduces students to the specific needs and procedures critical to ensure police officer and community safety. Students will develop the basic knowledge and skills that will enable them to effectively manage operational situations, use equipment and maintain safety.

### **Aim of this unit:**

The aim of this unit is to ensure that each student reaches a competent standard in the use of police appointments as well as officer safety techniques and tactics. The areas more specifically referred to are firearms, batons, handcuffs, weaponless control, defensive sprays, weaponless control, vehicle stops, building and bomb search.

### **Module One: Weaponless Control**

#### **Module descriptor:**

Students will be introduced to basic self-defence skills and will be able to apply defensive and restraining tactics. They will be required to demonstrate effective communication skills and operational tactics in a simulated initial response situation while also demonstrating a professional and ethical understanding of the legal use of force.

#### **Learning outcomes:**

At the end of the module students will be able to:

- a. apply basic self-defensive skills;
- b. apply defensive and restraining techniques;
- c. demonstrate ethical and professional understanding of the legal use of force;
- d. demonstrate effective communication skills.

### **Module Two: Use of equipment – batons, handcuffs and chemical agents**

#### **Module descriptor:**

Students will be introduced to equipment currently on issue to all members of the NSW Police Service. They will be expected to develop appropriate skills in the use of batons, handcuffs and chemical agents. Students will demonstrate their skills in these areas to the standard required by the Police Service and displaying correct judgement in the ethical and legal use of force.

#### **Learning outcomes:**

At the end of the module students will be able to:

- a. use operational appointments to the required standard;
- b. demonstrate ethical and professional understanding of the legal use of force;
- c. demonstrate effective communication skills.
- d. operational tactics in simulated environment.

### **Module Three: Use of equipment - firearms**

#### **Module descriptor**

Students will be introduced to the Glock 22 service pistol which is used by serving members of the NSW Police Service. They will be required to develop the knowledge and skills required to carry and use the firearm to the required Police Service standard.

#### **Learning outcomes:**

At the end of the module students will be able to demonstrate:

- a. knowledge of the service firearm and its function;
- b. use of the firearm to the required standard;
- c. ethical and professional understanding of the legal use of force;

- d. effective communication skills;
- e. operational tactics in simulated environment.

### **Module Four: Operational Safety Tactics – Buildings, Persons and Vehicles**

#### **Module descriptor:**

This module will introduce students to operational safety tactics, particularly in relation to initial response and confrontational situations. They will develop the knowledge and skills in relation to the searching and securing of buildings, persons and vehicles. These areas further enhance developing skills by applying them to building searches (for offenders or explosive devices) and motor vehicle stops.

#### **Learning outcomes:**

At the end of the module students will be able to demonstrate:

- a. how to search for an explosive device;
- b. through discussion, issues of safety and containment relating to explosive devices;
- c. ethical and professional understanding of the legal use of force;
- d. skills in the searching of premises;
- e. skills required to search a person in a safe and professional manner;
- f. operational tactics in a simulated environment;
- g. procedures in performing a motor vehicle stop.

### **Module Five: Drill**

This module trains the student to perform as a member of a disciplined body to accept and respond to lawful words of command. Drill prepares the students to perform effectively in situations of high stress, where instinctive obedience to lawful commands is essential for the success of the unit in achieving objectives. This is also a safety issue in effective policing.

Drill is a co-requisite for public order policing, which involves riot training, where drill formations are part of that training.

Part of this module is directed at the protocol aspects of police life, the correct protocol in paying compliments to Commissioned Officers, visiting dignitaries and Members of Parliament etc. (ie. saluting). Procedures and drills for ceremonial occasions, from the students' own passing out parade to participation and attendance at police funerals, are dealt with.

#### **Learning outcomes:**

At the end of the module students will be able to:

- a. participate in a disciplined manner when involved in public order policing;
- b. follow protocols for paying compliments to commissioned Officers, visiting dignitaries and other VIP's;
- c. apply appropriate drills and protocols during their passing out parade.

Each student will be required to attend all lessons programmed for their sub-class unless exempted through medical or other acceptable reason.

### **Module Six: Incident Management**

The New South Wales Police Service has a clear statutory responsibility to respond to and provide high quality on-site management in a wide range of operational and emergency situations.

#### **Learning outcomes:**

At the end of the module students will be able to:

- a. explain the appreciation process and demonstrate an ability to apply it to a range of situations;

- b. outline the concepts of command, control and coordination and how they relate to operational activities of the NSW Police Service;
- c. describe procedural requirements in the conducting of operational activities in the NSW Police Service;
- d. describe the police roles and responsibilities in rescue, evacuation and emergency management.

## **APPENDIX C: SUBJECT INFORMATION/PRE SCREENING**



Surname: .....	First Name: .....
Student No: .....	Date of Birth: ...../...../.....
Gender:        M        F	Test Date: ...../...../.....

**Body composition:**

This involves simple measurement of body height, weight and body fat levels. Body fat is estimated using standard skinfold thicknesses as measured by hand held calipers. It is important that you do not participate in strenuous physical activity and are not dehydrated prior to undertaking the assessment. You should wear shorts and a loose T-shirt.

**Strength tests:**

You will undergo a series of strength tests including handgrip, abdominal, upper body and lower body.

**Agility test:**

You will perform a short duration agility test to assess your ability to accelerate, to swerve, and to change direction as quickly as possible.

**Sprint test:**

Your sprint ability will be assessed by measuring the time taken to cover a 40-metre distance.

**Aerobic fitness:**

This test of cardiovascular fitness involves performing a 'Shuttle Run Test'. It consists of running back and forth over a 20 metre distance at an increasing pace until maximal effort is achieved.

*If you have any further questions, ask the tester prior to undergoing your assessment.*

## Pre-Screening Questionnaire (PAR-Q)

*Please note that all information that is gathered from the following questions is used for the purpose of pre-screening to determine if there may be any risks associated with undertaking some or all of the physical tests. No individual information will be released to any other person(s) other than the tester. Your right for confidentiality is respected and assured.*

**Please read and answer the following questions honestly.**

- |    |   |                       |                    |
|----|---|-----------------------|--------------------|
| 1. | Has your doctor ever said that you have a heart condition <u>and</u> that you should only do physical activity recommended by a doctor? | <b>YES</b>            | <b>NO</b>          |
| 2. | Do you feel pain in your chest when you do physical activity?   | <b>YES</b>            | <b>NO</b>          |
| 3. | In the past month, have you had chest pain when you were not doing physical activity?   | <b>YES</b>            | <b>NO</b>          |
| 4. | Do you lose your balance because of dizziness or do you ever lose consciousness?  | <b>YES</b>            | <b>NO</b>          |
| 5. | Do you have a bone or joint problem (including your back) that could be aggravated by physical activity?                                | <b>YES</b>            | <b>NO</b>          |
| 6. | Has your doctor informed you that you have high blood pressure?   | <b>YES</b>            | <b>NO</b>          |
| 7. | Has your doctor informed you that you have high cholesterol?  | <b>YES</b>            | <b>NO</b>          |
| 8. | Is your doctor currently prescribing you, medication for any of the following? (Please circle)  |                       |                    |
|    | <b>Asthma</b>   | <b>Blood pressure</b> | <b>Cholesterol</b> |
|    |   | <b>Stress</b>         | <b>Nil</b>         |
|    | <b>Other (including non-prescribed medication)</b> _____  |                       |                    |

- |    |                       |            |           |
|----|-----------------------|------------|-----------|
| 9. | Do you have diabetes? | <b>YES</b> | <b>NO</b> |
|----|-----------------------|------------|-----------|

*If you have answered YES to any of the above questions you will need to consult with the tester prior to any of the assessments being undertaken.*

- |     |   |                 |           |
|-----|---|-----------------|-----------|
| 10. | Is there a history of heart disease, stroke or raised cholesterol in your family?                           | <b>YES</b>      | <b>NO</b> |
| 11. | Do you smoke or have you smoked cigarettes / cigars / pipe?   | <b>YES</b>      | <b>NO</b> |
|     |   | <b>PREVIOUS</b> |           |
|     | (If <b>YES</b> or <b>PREVIOUS</b> , indicate number of years smoking: _____ years & cigarettes / day _____) |                 |           |
| 12. | Do you know of <u>any other reason</u> why you should not participate in physical activity?                 |                 |           |
|     | _____   |                 |           |
|     | _____   |                 |           |
| 13. | Do you suffer from asthma?  | <b>YES</b>      | <b>NO</b> |
| 14. | Do you have or have you had a stomach or duodenal ulcer?  | <b>YES</b>      | <b>NO</b> |
| 15. | Do you have or have you had a liver or kidney condition?  | <b>YES</b>      | <b>NO</b> |
| 16. | Do you suffer from epilepsy?  | <b>YES</b>      | <b>NO</b> |
| 17. | Do you have arthritis?  | <b>YES</b>      | <b>NO</b> |
| 18. | Do you have a hernia?   | <b>YES</b>      | <b>NO</b> |
| 19. | Have you been hospitalised or undergone surgery in the last 12 months?                                      | <b>YES</b>      | <b>NO</b> |

*I have informed the tester of details of all medical conditions that I have and of all recent medical treatment received by me. I have completed the foregoing questionnaire honestly and to the best of my knowledge and I am aware and understand the tests that I will be undertaking. The tester has answered all questions that I had to my satisfaction. I understand that the tester reserves the right based on medical grounds, to exclude me from performing some or all of the physical assessments.*

Name: \_\_\_\_\_

Signature: \_\_\_\_\_

Date: \_\_\_\_\_

<b>Results Sheet</b>
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	Site	Trial 1	Trial 2	Trial 3	
Mass(kg)					
Height(cm)					
Girth(cm)	Waist				
Skinfolds(mm)	Triceps				
	Subscapular				
	Biceps				
	Supraspinale				
	Abdominal				
	Front thigh				
	Medial calf				
	Sum of 7 sites				
Handgrip(kg)					
Vertical Jump(cm)					
Abdominal Strength(level)					
Upper body Strength(reps)					
Agility(secs)					
40 metre sprint(secs)					
Shuttle run(shuttle/level)					

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## **APPENDIX D: PHYSICAL ASSESSMENT PROTOCOLS**

The validity and accuracy of any test is compromised if the procedure for administering the test is altered in any way. In other words, if the test protocol is changed, the test results are invalid.

## **Handgrip Strength**

### **Purpose**

To assess the handgrip strength of the left and right hand.

### **Equipment**

Jamar® Hydraulic Hand Dynamometer, Sammons Preston, Bollingbrook, Illinois.

Calibration check should be performed regularly using masses that have been verified by a Government Department of Weights and Measures.

### **Testing Procedure**

Ask the subject to grasp the handgrip dynamometer, holding it in line with the forearm. With the upper arm held beside the body the elbow joint is flexed to 90 degrees. Adjust the width of the grip so that the second joint of the forefinger is almost at a right angle.

The subject should then stand at attention with the feet slightly apart. Their arm should be positioned alongside the body and the dynamometer should be grasped naturally.

Now instruct the subject to close the hand in a squeezing motion and squeeze vigorously, exerting the maximum force of which he/she is capable. The arm should not be swung or pumped violently. This may increase the recorded score.

Read the value obtained on the scale and record to the nearest kg. Measure twice each for the left and right hands.

To obtain the combined handgrip strength result, the best trials of left and right and right hands are added together.

## **Vertical Jump Test**

### **Purpose**

To assess lower limb strength/power.

### **Equipment**

Vertical jump board, talcum powder.

### **Technique**

After sufficient warm-up, the subject stands side on to the vertical jump board (either left or right side is permitted). The subject places talcum powder/chalk on the fingertips. With feet flat on the ground, and body close to the wall, the subject reaches as high as possible up the board with the hand closest to the board, leaving a mark at the height of full stretch. The height of this standing reach is recorded. The subject then crouches and jumps as high as possible without taking a step (counter movement jump), marking the wall at the peak of the leap with the inner hand. The arms are also used to propel the body upward. The jump height is recorded. The score is calculated by deducting the standing reach height from the jump height and is recorded to the nearest centimetre. The best of three trials is recorded with 30 seconds rest allowed between trials.

## **7 Stage Abdominal Strength Test**

### **Purpose**

To assess abdominal muscle strength.

### **Equipment**

Vinyl gymnastic mat with foam centre (1.8 m x 1.12 m x 50 mm)

### **Precautions**

This test should not be performed on subjects with any recent history of low back pain or chronic low back condition. Those who have an existing hernia, or who are more than three months pregnant should also be excluded.

### **Technique**

The following is a progressive one-repetition maximum (1RM) test of abdominal strength. Start all subjects on variation one. Each time a variation is successful, the subject attempts the next variation, until they come to a variation they cannot perform. The last successful variation is taken as the subject's maximum abdominal strength. An attempt is unsuccessful if a subject displays poor technique during a sit up by:

1. Lifting either heel off the floor.
2. Knees not being together and at right angles between the thigh and the lower limb.
3. Using jerking movements such as throwing the head or arms forward from the nominated position.
4. Lifting the hips off the floor.
5. Being unable to complete the nominated sit up (the subject is allowed two attempts at a level).

### **Technique**

The subject lies in a supine position on the mat. Adjust the knee angle so the femur and tibia are at 90 degrees axis at the knee joint. Ask the subject to place the hands in the position for level 1. The subject tilts the pelvis back to flatten the lower back onto the floor, then tilt the head forward and smoothly flex the trunk in a controlled manner until level 1 is completed then the subject returns to the starting position. If the sit up was successful place the subject in the position for the next level. Repeat steps 3 and 4 until the subject is unsuccessful. Record the previous sit up as the subject's abdominal strength.

### **Level 1**

Arms are held straight out resting on the subject's thighs. The subject slowly contracts the abdominals as the hands are moved up the thighs until the wrists are at the level of the knees.

### **Level 2**

Arms are held straight out resting on the subject's thighs. The subject slowly contracts the abdominals as the hands are moved up the thighs until the elbows are at the level of the knees.

### **Level 3**

Arms are folded at right angles across the subject's abdominals with hands holding opposite elbows. The chin is then tucked into the chest. As the abdominals are contracting and the upper body is moving toward the knees, arms are held in that position as the chest touches the knees and the forearms touch the thighs.

### **Level 4**

Arms are crossed on the chest with hands holding opposite shoulders. Chin is tucked into the chest. Maintaining the elbows in their position the abdominals are contracted and the upper body is moved until the elbows meet with the thighs.

### **Level 5**

Arms are flexed behind the head in a crossed position with hands held as far down the opposite shoulder as possible. The chin is tucked in at the chest. With control the abdominals are contracted and the upper body is moved until the chest touches the knees.

### **Level 6**

Same as level 5, with hands gripping the opposite sides of a 2.5 kg weight.

### **Level 7**

Same as level 5, with hands gripping the opposite sides of a 5.0 kg weight.

## **Push-Up Test (Upper Body Strength/Endurance)**

It is important that the test procedure be clearly described so as to prevent any subject modifying the test to his or her advantage by including incorrect repetitions.

### **Equipment**

A flat non-slippery surface or mat

### **Purpose**

To assess the physical component of upper body strength/endurance (extension).

### **Procedure**

Arms straight, hands directly under the shoulders, legs straight, feet together with toes supporting the weight of the legs. The body is straight from the shoulders, through the hips to the heels. Lower the body until the elbow is in at least a 90 degree position, keeping the straight body position. This counts as one repetition.

### **Scoring**

Score by the number of correct repetitions performed in a continuous manner (up to a maximum set level of 25).



## Agility Test

### **Purpose**

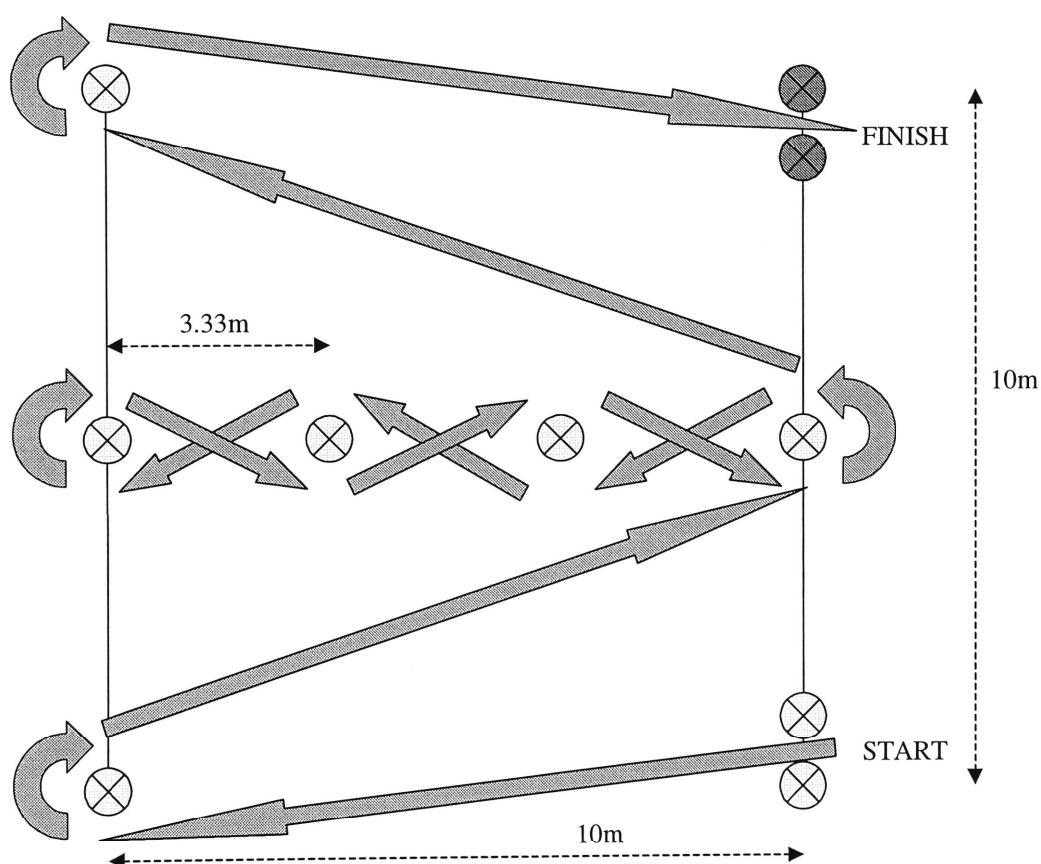
The purpose of this test is to assess the person's ability to accelerate, to swerve, and to change direction as quickly as possible.

### **Equipment**

Two lines ten meters apart represent start/stop and turning points. In the centre perpendicular to the two ten metre lines are four markers, spaced 3.33 meters apart (see diagram below). Witches hats (23cm).

### **Technique**

On the command "GO"; the subject sprints from behind the starting line (from a standing start), to the far line turning around the opposite marker then returning to the starting line to run around the four center markers, zigzagging around up and back to finally sprint once more across to the far line, running around the diagonally opposed marker to the start then sprint back to cross the starting line (see diagram below).



## 40 Metre Sprint Test

### **Purpose**

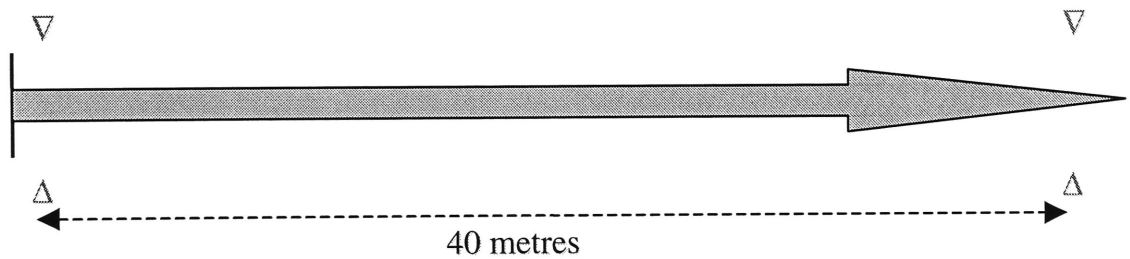
To assess the ability to sprint over short distances.

### **Equipment**

- Flat surface of at least 70 metres in length. The surface should be made of a hard, non-slip compound (ie. bitumen/cement).
- G-Speed 100 – Infrared Gate Timing Lights, Onspot.

### **Technique**

The subject is to have warmed up and stretched prior to testing. The subject is to stand 30 cm behind the line of the timing lights. In their own time, the subject is to sprint as fast as possible from the start line until passing through the timing lights at the 40 metre mark. The subject has two attempts and the best trial is recorded.



## **Multi-Stage Fitness Test (Shuttle Run)**

### **Purpose**

To assess aerobic power.

### **Equipment needed**

- Flat non-slippery surface at least 22 metres in length
- Cassette player
- Multi-stage fitness test tape (Australian version), Australian Coaching Council, ASC.
- Measuring tape to measure the 20-metre track
- Markers cones
- Approximately 1.5 metres of width per person
- Recording sheets to record assessment results

### **Precautions**

Subjects with cardiorespiratory ailments, recent injury, or surgery to the shoulders, hips, knees or ankles without medical clearance should be excluded from this test.

### **Subject Warm-up**

The applicants who are to perform the test are to be warmed with a 3 minute jog followed by some stretching exercises, concentrating on the lower limb.

### **Before the test, subjects:**

- Should not eat for at least 2 hours prior to the test
- Must wear suitable athletic clothing and footwear to prevent slipping
- Should not undertake heavy training the day previous to the test
- Should not consume alcohol or cigarettes prior to the test

### **Starting the test**

There are instructions for the test on the tape followed by a five second countdown to start the test. When the test starts there is single bleep at regular intervals. The subject should aim to be at the opposite end to the start by the time the bleep sounds. They should then continue running at this speed, being at one end or the other each time there is a bleep.

After each minute, the time between bleeps will decrease so that running speed will need to be increased. At the end of each minute there will be a triple bleep and a message from the commentator on the tape, to indicate the next run will need to be faster. The first running speed is referred to as 'level 1', the second speed as 'level 2', and so on.

Each subject should run for as long as possible, until he/she can no longer keep up with the speed of the tape. The test is maximal and progressive. Individuals should be encouraged to put in 100% effort so ascertain the best result possible.

Testers should make a note of the level, and the number of shuttles into the level, at which the subject withdraws from the test.

### **After the Test**

The participants should cool down at the completion of the test by walking followed by stretching.

### **Points to Watch:**

- Remind the subjects that the initial speed is slow and they should not begin too quickly
- Ensure that one foot is on or behind the line at the end of each shuttle
- Ensure that the subjects pivot to turn and do not run a wide arc
- When the subject is two or more steps from the line, two shuttles in a row, withdraw the subject

## Skinfold Measurements

### **The Subject**

Throughout the marking and measurement session, the subject stands relaxed, arms comfortably to the side allowing the measurer to move around and manipulate the caliper. Subjects must be informed which measurements are to be taken and must complete a consent form prior to assessment.

### **Equipment**

The Harpenden skinfold caliper is used as the criterion instrument by ISAK. The caliper should be calibrated for jaw pressure and gap width (Carlyon *et al.*, 1996). These calipers should have a compression of 10 g.mm<sup>-2</sup>, are calibrated to 40 mm in 0.2 mm divisions and may be accurately interpolated to the nearest 0.1 mm. The caliper springs should be replaced annually. The measuring tape used for the identification of sites is the Lufkin Executive Diameter tape (W606PM).

### **Anatomical Landmarks**

Landmarks are identifiable skeletal points that generally lie close to the body's surface and are the 'markers' that identify the exact location of the measurement site. All landmarks are found by palpation. For the comfort of the subject, the measurer's fingernails should be kept trimmed. The landmark is identified with the left hand, usually with the thumb. The site is released to remove any distortion of the skin, then it is relocated and marked with the thumb nail. Using a fine-tipped felt pen the site is marked directly over the landmark. The pen mark is then checked to ensure that there has been no displacement of skin relative to the underlying bone. All landmarks are identified and marked before any measurements are made. All are marked on the right hand side of the body.

#### **Acromiale**

Definition: The point at the superior and lateral border of the acromion process, midway between the anterior and posterior borders of the deltoid muscle when viewed from the side.

Location: Standing behind and on the right hand side of the subject, palpate along the spine of the scapula to the corner of the acromion. This represents the start of the lateral border, which usually runs anteriorly, slightly superiorly and medially. Apply the straight edge of a pencil to the lateral aspect of the acromion to confirm the location of the border. The landmark is the point on the most lateral and superior part of the border, which is adjudged to be in the mid-deltoid position when viewed from the side.

#### **Radiale**

Definition: The point at the proximal and lateral border of the head of the radius.

Location: Palpate downward into the lateral dimple of the right elbow. It should be possible to feel the space between the capitulum of the humerus and the head of the radius. The most superior lateral border of radius is marked.

#### **Mid-acromiale-radiale**

Definition: The point equidistant from acromiale and radiale.

Location: Measure the linear distance between acromiale and radiale with the arm relaxed and extended by the side. Place a small horizontal mark at the level of the mid-point between these two landmarks. Project this mark around to the posterior and anterior surfaces of the arm as a horizontal line. This is required for locating the triceps and biceps skinfold sites. When marking the sites for triceps and biceps skinfolds the subject must assume the anatomical position. The triceps skinfold is taken over the most posterior part of the triceps and the biceps skinfold is taken over the most anterior part of the biceps when viewed from the side (at the marked mid-acromiale-radiale level).

#### **Subscapulare**

Definition: The undermost tip of the inferior angle of the scapula.

Location: Palpate the inferior angle of the scapula with the left thumb. If there is difficulty locating the inferior angle of the scapula, the subject should slowly reach behind the back with the right arm. The inferior angle of the scapula should be felt

continuously as the hand is again placed by the side of the body. A final check of this landmark should be made with the hand by the side in the functional position.

### **Iliocristale**

**Definition:** The point on the most lateral aspect of the iliac tubercle on the ilio-axilla line.  
**Location:** With the subject's arm placed horizontally in a lateral position, locate the most lateral superior edge of the ilium using the right hand. The left hand is used to stabilise the body by providing resistance on the left side of the pelvis. The landmark is made at the identified edge of the ilium which is intersected by an imaginary vertical line from the mid-axilla.

### **Iliospinale**

**Definition:** The most inferior or undermost tip of the anterior superior iliac spine.  
**Location:** Palpate the superior aspect of the ilium and follow anteriorly and inferiorly along the crest until the prominence of the ilium runs posteriorly. The landmark is the lower margin or edge where the bone can just be felt. Difficulty in appraising the landmark can be assisted by the subject lifting the heel of the right foot and rotating the femur outward. Because the sartorius muscle originates at the site of the iliospinale, this movement of the femur enables palpation of the muscle and tracing to its source. Once the landmark is identified, it is marked using the standard procedures, the subject standing with feet together and weight evenly distributed.

### **Skinfold measuring technique**

The skinfold is raised by the left hand which is positioned so that the thumb points downward and the back of the hand is in full view of the measurer.

The skinfold is raised with the thumb and index finger of the left hand picking up a double layer of both adipose tissue and skin. In order to eliminate muscle, the index finger and thumb roll the fold slightly thereby also ensuring that there is a sufficiently large grasp of the fold. The fold is grasped firmly and held throughout the measurement procedure.

The near edge of the finger and thumb, in line with and straddling the landmark, raise the fold in the direction specified for each site. The fingers pull the fold slightly away from the body which gives the calipers better purchase on the fold and reduces the chance of them slipping off.

The calipers are held in the right hand with the fingers operating the movable arm. A full sweep of the needle is 20 mm and this is reflected on the small scale on the caliper face. Before using the caliper make sure that the needle is on zero. Rotation of the outer ring of the caliper is used to adjust the position of the caliper dial directly under the needle.

The calipers are applied to the fold so that there is 1 cm between the near edge of the fingers and the nearest edge of the caliper face. The caliper needs to be placed high enough not to be in contact with the non-fold surface which might grip and exaggerate the size of the fold but not to close to the top of the fold from which it might slip off. The calipers are always applied at right angles to the fold.

The reading of the dial to 0.1 mm is made 2 seconds after permitting full spring pressure of the instrument by a complete release of the caliper trigger. In the case of large skinfolds the needle may still be moving at this point. The measurement is nevertheless recorded at this time. Take duplicate measures at each site ensuring rotation throughout sites before returning for second measurement. This allows time for the skin to regain its normal texture and thickness. The average of the 2 readings is used. If there is a large discrepancy between duplicate measurements a third measurement is obtained and the median is used. All measurements are taken on the right side of the body.

### **Triceps**

This skinfold is raised with the left thumb and index finger on the marked posterior mid-acromiale-radiale line. The fold is vertical and parallel to the line of the upper arm.

**Subscapular**

This skinfold is raised with the left thumb and index finger at the marked site 2 cm along a line running laterally and obliquely downwards from the subscapular landmark at an approximate 45 degree angle as determined by the natural folds of the skin.

**Biceps**

The skinfold is raised with the left thumb and index finger on the marked mid-acromiale-radiale line on the anterior surface, so that the fold runs vertically, parallel to the axis of the upper arm.

**Supraspinale**

This skinfold is raised at the point where the line from the iliospinale landmark to the anterior axillary border (armpit) intersects with the superior border of the ilium. The fold follows the natural fold lines running medially downward at about a 45 degree angle from the horizontal.

**Abdominal**

The caliper is applied 1 cm inferiorly to the left thumb and index finger, raising a vertical fold that is 5 cm lateral to, and at the level of the omphalion (mid point of navel). Do not place the calipers inside the navel.

**Front Thigh**

The measurer stands facing the right side of the subject on the lateral side of the thigh. The subject's knee is bent at 90 degrees by having the subject place the right foot on a box or being seated. The site is marked parallel to the long axis of the femur at the mid-point of the distance between the inguinal fold and the superior border of the patella. The skinfold measurement can be taken while the knee is bent or with the leg straight and resting on a box. If the fold is difficult to raise, ask the subject to extend the knee joint slightly by moving the foot forward to relieve the tension of the skin. If there is still difficulty, the subject may assist by lifting the underside of the thigh to relieve the tension of the skin. As a last resort for subjects with particularly tight skinfolds, an assistant (standing on the medial aspect of the subject's thigh) can assist by raising the folds using two hands so that there is 6 cm between the fingers of the right hand raising the fold at the correct anatomical landmark and the left hand which raises a distal fold. The calipers are then located in between the assistant's hands, 1 cm from the assistant's thumb and forefinger of the right hand.

**Medial Calf**

With the subject in the standing position, weight evenly distributed on both feet, the greatest calf girth is identified and marked on the medial aspect. The subject is either seated or standing with their foot on a box, the knee is flexed at 90 degrees and the calf is relaxed. The vertical fold is raised on the medial aspect of the calf at the marked level of greatest circumference.

*The description of the anthropometric sites and measurement procedures are in accordance with ISAK (International Society for the Advancement of Kinanthropometry) and adapted from Norton et al., (1996).*

## **APPENDIX E: OPERATIONAL SKILLS PERFORMANCE ASSESSMENT**

Student Name: \_\_\_\_\_ Student No: \_\_\_\_\_

**JST100 Weaponless Control Program**

- Poor force displayed with angle/side kick, inside thigh kick, front kick or knee strike ☐ Yes ☐ No
- Poor strength with getting to wrist lock position ☐ Yes ☐ No
- Poor strength displayed with leg sweep ☐ Yes ☐ No
- Poor strength with arm bar take down ☐ Yes ☐ No
- Considerable fatigue during training ☐ Yes ☐ No
- Other (please specify)..... ☐ Yes ☐ No

**JST100 Baton Training Program**

- Poor baton control as related to poor strength ☐ Yes ☐ No
- Poor/low force application with striking (as related to strength, not skill) ☐ Yes ☐ No
- Considerable fatigue during training (wrist, forearm etc.) ☐ Yes ☐ No
- Poor baton retention ability (as related to poor strength) ☐ Yes ☐ No
- Poor application of come along hold due to lack of strength (arms/shoulders etc.) ☐ Yes ☐ No
- Other (please specify)..... ☐ Yes ☐ No

**JST100 Firearms Program**

- Poor ability to rack slide (as a result of poor hand/finger strength, not skill) ☐ Yes ☐ No
- Poor ability to load magazine (as related to lack of strength, not skill) ☐ Yes ☐ No
- Pistol dropping low before firing (strength related) ☐ Yes ☐ No
- Enhanced/accentuated recoil related to poor grip strength ☐ Yes ☐ No
- Increased recoil causing increased time of readjustment back to centre of target ☐ Yes ☐ No
- Stoppage/stovepipe caused ☐ Yes ☐ No
- Poor strength for disassembly of weapon ☐ Yes ☐ No
- Other (please specify)..... ☐ Yes ☐ No

**JST100 Public Order Policing**

- Poor ability to maintain speed with the majority of the group ☐ Yes ☐ No
- Other (please specify)..... ☐ Yes ☐ No

Additional Comments: \_\_\_\_\_

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