CHAPTER 4:

METHODS AND PROCEDURES: DEVELOPING THE JOB ACCOMMODATION TOOL

4.1. Determine which tests are applicable to which tasks

The critical movements and exertions (also called critical physical demands) for the tasks found in the technician position were listed in the previous chapter. It was also explained that each of these critical physical demands are linked to a specific test in the physical ability test battery. More correctly, each test was designed to measure a specific critical physical demand. The next challenge was to link these tests to the relevant tasks by showing which critical physical demands are applicable to which tasks. Once this has been done the tests would automatically be linked to the specific tasks through the critical physical demands.

The first step was to draw up a grid with the tests and the critical physical demands on the one axis and the actual tasks related to the job outputs on the other axis. Table 4.1 is an example, showing what is meant by this.

Table 4.1. Example of a grid with the tests and critical physical demands on the one axis and the work tasks on the other axis:

	Test 1	**Test 2**	**Test 3**	**Test 4**	**Test 5**	**Test 6**
	Demand 1	**Demand 2**	**Demand 3**	**Demand 4**	**Demand 5**	**Demand 6**
Task 1			X		X	
Task 2	X	X		X	X	
Task 3	X		X		X	
Task 4	X		X		X	X
Task 5			X		X	
Task 6		X			X	X
Task 7					X	

For the purposes of this thesis a grid similar to the one shown in table 4.1 had to be drawn up for the technician position. The real grid was much larger due to the greater number of tasks and critical physical demands, but in essence it was used exactly as shown here. Each critical physical demand enjoyed individual focus as each task was thoroughly analysed to determine which tasks are linked to that demand. Once a definite link has been made, the block linking the relevant demand and the task being analysed is marked with an "X". This indicates that the demand and its related test is relevant for that task. This process had to be repeated for each and every critical physical demand.

For this exercise to be successful and accurate, far more input and research than the knowledge and insight of the researcher alone were required. Here follows the methods that were used to ensure that the final product would be accurate and complete.

4.1.1. Task observation

All the critical tasks were observed as they were being performed by technicians in the field. The objective being to recognise the critical physical demands within each work task (if present). This, in turn, also linked the tests in the physical ability test battery to the relevant tasks. The main advantage of observations in the field was that questions could be asked and comments could be heard. It also provided a better understanding of task intensity, -frequency and -importance. The researcher used a grid similar to the one in table 4.1 to ensure that all relevant tasks were observed and to indicate when a link between a task and a critical physical demand existed.

4.1.2. Video analysis

Video recordings of all the critical tasks were studied and analysed. Each task was thoroughly investigated and the objective was once again to recognise the critical physical demands within the actual work tasks. A grid was again used (similar to the example in table 4.1). The biggest advantage of video analysis was that each task could be watched an unlimited number of times as it was being executed in the field. Video-recorder functions such as "pause" and "slow motion" were also of great value.

4.1.3. Task performance

As with most things, actually performing a task provides a different and often more valuable insight into the dynamics, movements and exertions involved in that task. The researcher performed a number of the tasks, simulating the actual techniques and using the actual tools that are being used by the technicians when performing these tasks. This assisted greatly in the process of linking critical physical demands to work tasks. It is, however, important to remember that some tasks do go together with a degree of physical risk to the person performing the task (or to others). These tasks should best not be attempted by someone who is not qualified to perform them.

4.1.4. Professional opinion

Seeing that the experts in the mentioned position and its work outputs are not experts in human movement science and physical work capacity, it was important that the researcher also made use of his / her own expertise as well as the expertise of others in this field. For the purposes of this thesis (and more specifically for the matching of the tests to the tasks) the researcher consulted with a well-known expert in the field of physical work capacity. Once a specific task is well known and understood by such an expert, he / she is probably in the best position to recognise the required links. This makes sense if one considers their knowledge on aspects such as human anatomy, human movement and biomechanics.

4.1.5. Practical experience

This section refers to the consultation sessions with supervisors and technicians themselves. These experts in the job itself play a major role in clarifying certain tasks or job outputs to the researcher. They also assist greatly in the so-called “grey areas” where the researcher is in need of more specific information or when there is uncertainty regarding a specific task and the exertions involved in that task.

4.2. Determine the weighting of each physically-demanding job output

One of the big motivations behind developing a job accommodation tool was that managers, supervisors, human resources personnel and other health professionals would benefit from the implementation thereof. The main idea was to provide more specific information by linking the physical ability tests with the actual tasks performed in the field and then informing the decision makers on exactly which tasks the subject would be able to perform safely and which not. There is however one other factor which often affects the decisions taken by the mentioned people and that has to do with the percentage of the total work outputs that the subject will be able to perform. This is particularly advantageous when permanent disabilities come into play and a decision has to be taken on whether the subject could still add sufficient value in his / her current job or if an alternative position needs to be found (if possible).

For the purpose of developing a tool that would provide such a percentage the researcher decided to take an approach based on the specific job outputs applicable to a job and to make use of a “weighting” system that would include three very important factors. This approach makes use of the frequency, duration and importance of each job output since some outputs may be performed more frequently, be more time consuming or may be more important than others. By combining these factors to calculate the weight of each job output, through standard mathematical methods, the researcher is able to accurately calculate the percentage of the total job outputs that the subject will be able to perform. This is done by firstly using the job accommodation tool to identify the tasks that the subject will be able to perform and secondly, using this information to determine which job outputs matches his / her current ability. Now the applicable weightings are simply added together to calculate the percentage of the total job outputs that can safely be performed by the subject.

In order to calculate the weight of each job output, data had to be collected from specialists in the field of the applicable job. This was done by conducting interviews with 84 of these specialists which included site supervisors, immediate superiors and technicians. The interviews were conducted with willing and available specialists throughout the country and each interview lasted between 30 and 60 minutes. An interview questionnaire was used during these interviews as the subjects were asked to rate each job output in terms of the three rating scales. The rating data, acquired from the interview questionnaires, were then used to calculate the final rating for each job output.

A standardised questionnaire was used during the interviews and it was based on the task breakdown shown in 3.5.1.1. As mentioned earlier, three scales were used for the weighting part of the questionnaire. The three scales were identified in the literature and slightly adjusted, where necessary, for the purposes of this study. The "frequency" scale was adjusted from Gael (1988), the "duration" scale from Ghorpade (1988) and the "importance" scale also from Gael (1988). Table 4.2 shows the three scales used in the questionnaire. Appendix 4 provides an exact example of the questionnaire used during the interviews.

<u>Table 4.2. The 3 scales used to determine the weighting of each job output:</u>

Frequency		**Duration (compared to other job outputs)**		**Importance (compared to other job outputs)**	
1	1 to 4 times per year	**1**	Extremely small amount of time	**1**	Very low importance
2	Once every 2 months	**2**	Small amount of time	**2**	Low importance
3	Once or twice per month	**3**	Below-average amount of time	**3**	Moderately low importance
4	Once or twice every 2 weeks	**4**	Average amount of time	**4**	Average importance
5	Once or twice per week	**5**	Above-average amount of time	**5**	Moderately high importance
6	Almost every day	**6**	Large amount of time	**6**	High importance
		7	Extremely large amount of time	**7**	Very high importance

Once all the data had been gathered the calculations could begin. The first step was to calculate the mean frequency score, mean duration score and mean importance score for each job output. Once this had been done the following steps could be followed to calculate the final weightings:

(1) add the three scores together for each work output in order to get one score out of 20;
(2) calculate the "output score" ("A") for each work output by multiplying the score out

of 20 by 5 to get a score out of 100 for each work output (this is the “output score”);

(3) now divide each of the output scores by “X”;

(4) “X” is calculated by adding all 22 output scores together and then multiplying this total output score by 1/100 (this will give you “X”);

(5) now divide each of the 22 output scores (A’s) by “X” to get “% of total work outputs” for each individual work output.

In summary, here follows the formulas to be used:

$$\text{\% of total work} = \frac{A}{X}$$

$$A = [\ \text{Frequency} + \text{Duration} + \text{Importance}\ ] \times 5$$

$$X = [\ \textstyle\sum \text{of all A`s}\ ] \times \frac{1}{100}$$

4.2.1. Calculation of actual weightings of work outputs for the technician position

The 22 work outputs measured in terms of their weighting, for the purposes of calculating the percentage of the total work outputs a person will be able to perform, were as follows:

- Maintenance: Perform vegetation control in company’s servitudes (1.1 on questionnaire);
- Maintenance: Maintain access routes and security infrastructure (1.2 on questionnaire);
- Maintenance: Maintain lines and structures: Replacing and securing (1.3 on questionnaire);
- Maintenance: Maintain lines and structures: Cleaning (1.4 on questionnaire);
- Maintenance: Maintain lines and structures: Conductor work (1.5 on questionnaire);

- Maintenance: Maintain lines and structures: Trenches and structures (1.6 on questionnaire);
- Maintenance: Maintain lines and structures: Foot patrols (1.7 on questionnaire);
- Maintenance: Maintain lines and structures: Vehicle patrols (1.8 on questionnaire);
- Maintenance: Maintain substations and control rooms: Security and safety lighting (1.9 on questionnaire);
- Maintenance: Maintain substations and control rooms: Batteries (1.10 on questionnaire);
- Maintenance: Maintain substations and control rooms: Reporting any other abnormality found (1.11 on questionnaire);
- Maintenance: Maintain substation and control rooms: Executing vegetation control (1.12 on questionnaire);
- Maintenance: Work order feedback and clearance (1.13 on questionnaire);
- Repair: Being on standby (2.1 on questionnaire);
- Repair: Restoring equipment and structures on lines and substations (2.2 on questionnaire);
- Building: Poles and structures (3.1 on questionnaire);
- Building: Installing and dismantling (3.2 on questionnaire);
- Building: Conductors (3.3 on questionnaire);
- Building: Securing trenches and structures (3.4 on questionnaire);
- Health and Safety (4 on questionnaire);
- Customer service (5 on questionnaire); and
- House keeping: Maintaining an ergonomically sound and hygienic workplace (6 on questionnaire).

Table 4.3 shows the actual scores, percentages and weightings for each work output involved in the technician position. These scores, percentages and weightings were calculated from the data gathered during the 84 interviews. Furthermore, figure 4.1 provides a graphic view of the weights of the work outputs. As is shown in table 4.3 and figure 4.1, output 1.5 had the greatest weighting with output 1.3 following closely. In contrast, output 1.7 had the lowest weighting and output 1.9 had the second lowest rating.

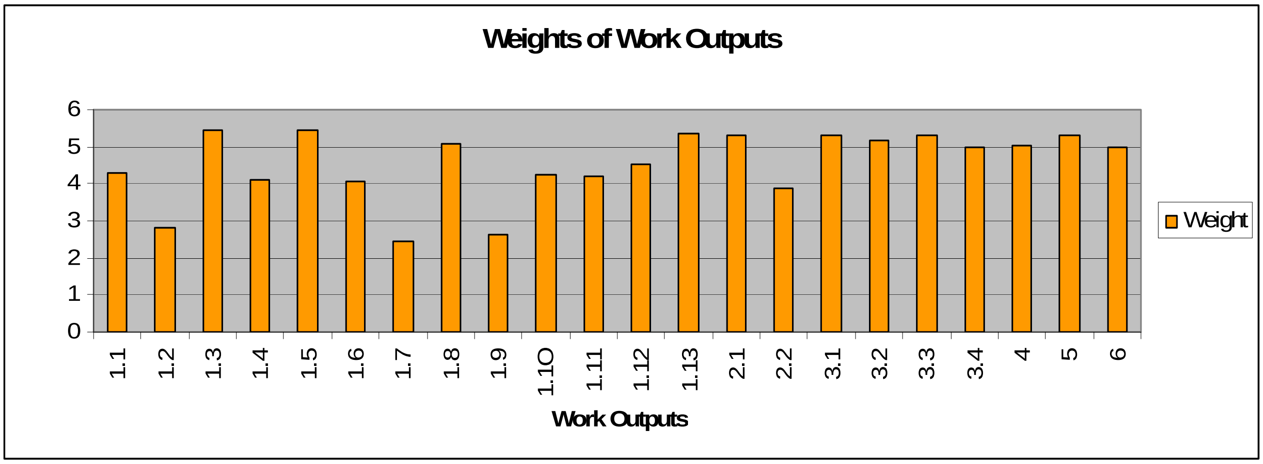

Figure 4.1: Graphic view of weight of each work output

4.3. Finalising the task-specific job accommodation tool

Once all the relevant information had been gathered and the calculations had been made the final product could begin to see the light. Once the grid, as shown in table 4.1, was ready, the process of developing the job accommodation mask could commence. Firstly, all the gathered information was used to link each critical physical demand with the relevant tasks for that demand. These links were indicated by way of an “X” on the grid. Once this task had been completed, each white block on the grid (those blocks without an “X”) could be coloured with dark grey in order to indicate that, that block is not applicable. Once all the white blocks had been coloured, the “X’s” could be deleted, leaving a mask with white blocks and dark grey blocks. The white blocks indicating a link between a critical physical demand and a task and the grey blocks indicating that there was no link. The mask was now complete.

Table 4.3. The actual scores, percentages and weightings for each work output in the technician position:

							N = 84 **X = 16.69345**
Output	Average Frequency Score (F)	Average Duration Score (D)	Average Importance Score (I)	∑ F,D,I	Output score (A)	% of total outputs	Weight of output
1.1	4.571429	4.119048	5.654762	14.34524	71.7262	4.296667%	**4.3**
1.2	2.059524	3.095238	4.297619	9.452381	47.26191	2.831165%	**2.83**
1.3	5.452381	6.27381	6.380952	18.10714	90.5357	5.423427%	**5.43**
1.4	3.678571	4.880952	5.22619	13.78571	68.92855	4.129078%	**4.13**
1.5	5.488095	6.166667	6.511905	18.16667	90.83335	5.441257%	**5.44**
1.6	4.333333	4.27381	4.952381	13.55952	67.7976	4.061329%	**4.06**
1.7	1.785714	2.416667	4.02381	8.22619	41.13095	2.463898%	**2.46**
1.8	5.071429	5.952381	5.928571	16.95238	84.7619	5.077554%	**5.08**
1.9	2.964286	2.75	3.142857	8.857143	44.28572	2.65288%	**2.65**
1.10	4.5	4.488095	5.22619	14.21429	71.07145	4.257445%	**4.26**
1.11	4.52381	4.345238	5.119048	13.9881	69.9405	4.189697%	**4.19**
1.12	4.440476	4.595238	6.059524	15.09524	75.4762	4.521428%	**4.52**
1.13	5.488095	6.071429	6.27381	17.83333	89.16665	5.341415%	**5.34**
2.1	5.369048	6.130952	6.190476	17.69048	88.4524	5.298629%	**5.3**
2.2	4.297619	4.178571	4.416667	12.89286	64.4643	3.861652%	**3.86**
3.1	5.357143	6.22619	6.214286	17.79762	88.9881	5.33072%	**5.33**
3.2	5.357143	5.880952	6.095238	17.33333	86.66665	5.191656%	**5.19**
3.3	5.428571	6.154762	6.166667	17.75	88.75	5.316456%	**5.32**
3.4	5.190476	5.654762	5.75	16.59524	82.9762	4.970584%	**4.97**
4	5.357143	5.047619	6.416667	16.82143	84.10715	5.038332%	**5.04**
5	5.47619	6.297619	5.964286	17.7381	88.6905	5.312792%	**5.31**
6	5.190476	5.452381	6.02381	16.66667	83.33335	4.991979%	**4.99**

Lastly, the weight of each work output could be indicated next to it. This completed the job accommodation tool for the technician position (tests, minimum physical requirements, cut scores, critical physical demands, job outputs, job tasks, the mask and the weighting of each job output). The tool could now be used to provide valuable job accommodation information relating to an individual, which would include the specific tasks that this person would be able to perform as well as the percentage of the total work outputs that he / she would be able to perform. Annexure 5 shows the completed job accommodation mask for the technician position.

CHAPTER 5:
RESULTS

5.1. The final product

The results of this study are shown in Annexure 5. Related documentation can also be seen in Annexures 2, 3 and 6, with the test battery and the minimum physical requirements for the technician position in Chapter 3. The final product (total job accommodation tool) can therefore be seen as the:

(1) informed consent form (annexure 2);
(2) physical ability data form (annexure 3);
(3) physical ability test battery (chapter 3, section 3.3.5);
(4) minimum physical requirements (chapter 3, section 3.4.2);
(5) job accommodation mask (annexure 5); and the
(6) job accommodation report form (annexure 6).

5.1.1. The link between each critical physical demand and the job outputs

The job description for the technician position consists of 22 job outputs. Each job output consists of one or more tasks that make up that job output. Through the job accommodation tool, the critical physical demands (each of which are tested as part of the physical ability test battery) are linked to the job outputs and the related tasks. By using the job accommodation tool and more specifically the "mask," it is possible to calculate the percentage of the total job outputs that are linked to each critical physical demand. This is made possible by the weightings that have been calculated for each job output. The researcher felt it would be interesting and of value to indicate these links and in so doing, indicating which tests and critical physical demands are the most important for the technician position. Table 5.1 shows all the critical physical demands as well as the percentage of the total job outputs not linked to each demand. It also shows the percentage of outputs that are linked to each demand.

If, for example, it is indicated that 41.29% of the total outputs are not linked to that demand (as is the case for "lifting above head with two hands"), it means that should an individual not meet the minimum physical requirement for only this test, he / she will still be able to perform 41.29% of the total job outputs. He / she will, however, not be able to perform 58.71% of the outputs due to the fact that 58.71% of the outputs are linked to this critical physical demand. Table 5.1 furthermore shows that "back extension strength" and "grip strength" are the most critical of the demands as they are both linked to 61.54% of the total job outputs for the technician position. They are closely followed by "lifting above head with two hands" and "trunk stability." "Arm adduction strength," on the other hand, are linked to only 25.35%. It can therefore be said that "arm adduction strength" is the least important of the critical physical demands as an individual will still be able to perform 74.65% of the total job outputs despite being below the minimum physical requirement for this demand.

Table 5.1: The link between each critical physical demand and the job outputs:

Critical physical demand	% of outputs not linked to critical physical demand	% of outputs linked to critical physical demand
Lifting above head with two hands	41.29	58.71
One handed lifting from floor	68.1	31.9
Arm adduction strength	74.65	25.35
Shoulder endurance at eye level	43.36	56.64
Balance	46.19	53.81
Arm flexion strength	43.79	56.21
Back extension strength	38.46	61.54
Leg extension strength	42.76	57.24
Cardiovascular endurance	54.78	45.22
Grip strength	38.46	61.54
Trunk stability	41.29	58.71

5.1.2. The link between each critical physical demand and the tasks

When looking at the tasks involved in the 22 job outputs, 82 separate tasks have been identified for the technician position. By using the job accommodation tool and more specifically the "mask," one can clearly see which tasks are linked to each critical physical demand (and the test related to that demand). Table 5.2 summarises this by showing all the critical physical demands as well as the number of tasks not linked to each demand. It also shows the number of tasks that are linked to each demand.

If one looks at "lifting above head with two hands," for example, 51 of the tasks are not linked to this particular critical physical demand. This means that 51 of the 82 tasks could still be performed, should the individual not meet the minimum physical requirement for only this demand. The other 31 tasks will not be recommended in such a case. "Back extension strength" and "grip strength" are linked to the most tasks and these two demands can therefore once again be justified as the most important of the critical physical demands. They are closely followed by "shoulder endurance at eye level," "balance," "trunk stability" and "lifting above head with two hands," in this order. At the other end of the spectrum "arm adduction strength" is linked to the fewest tasks, followed by "cardiovascular endurance" and "one handed lifting from floor."

Overall there are a number of similarities between table 5.1 (focussing on the links with the job outputs) and table 5.2 (focusing on the links with the specific tasks). Especially when one looks at the critical physical demands with the most links and the critical physical demands with the least links. This is to be expected, but one should not loose sight of the fact that table 5.1 has to do with "weighting" (which was calculated through frequency, duration and importance) while table 5.2 is placing the focus on the number of specific tasks that are linked to each critical physical demand. This is also the reason why there will be slight differences when comparing the two tables.

Table 5.2: The link between each critical physical demand and the tasks:

Critical physical demand	Number of tasks not linked to critical physical demand	Number of tasks linked to critical physical demand
Lifting above head with two hands	51	31
One handed lifting from floor	62	20
Arm adduction strength	73	9
Shoulder endurance at eye level	45	37
Balance	48	34
Arm flexion strength	52	30
Back extension strength	37	45
Leg extension strength	52	30
Cardiovascular endurance	63	19
Grip strength	39	43
Trunk stability	50	32

5.2. Implementation of the job accommodation tool

Chapter 6 will demonstrate the use and the value of the task-specific job accommodation tool by way of three case studies, but following is a short description of how the tool is to be implemented.

Firstly the subject is be assessed with the physical ability test battery (after completing an informed consent form). Once the tests have been completed the results are compared to the minimum physical requirements (or more correctly the “cut scores”) for the relevant position. The subject should now receive an “M” (meets minimum physical requirement) or a “D” (does not meet minimum physical requirement) for each of the physical ability tests performed. On the job accommodation tool there is a vacant block for the test result of each test. Only an “M” or a “D” is to be written into each of these blocks. Once this has been done, each “D” (if any) must be used to complete the mask. In the column underneath each "D" all the white blocks are to be marked with a red "X." This process must be repeated for each "D" scored. Once all the white blocks in the column underneath each "D" have been marked it would be clear which tasks this individual would be able to perform safely and efficiently and which not. If there are one or more red "X's" next to a task it should be recommended that the individual should not perform the applicable task.

The next step is to calculate the percentage of the total work outputs that this individual will be able to perform. If any red "X's" are present in the tasks that make up a work output, that output should be highlighted with the colour red. This would indicate that the applicable output should not be performed by the subject as that job output may hold a physical risk for the subject. Once all the applicable work outputs have been highlighted, the weightings of the remaining work outputs (not highlighted with red) should be added together and the sum of these outputs would then give an indication of the percentage of the total work outputs that could safely be performed.

Once the steps mentioned have been followed and the relevant information has revealed itself, the "report form" should be completed. The information on the job accommodation mask must be used to complete the report form (see Annexure 6). This report form with its recommendations should be handed to the relevant parties in the job accommodation process.

CHAPTER 6:

IMPLEMENTATION OF THE FINALISED JOB ACCOMMODATION TOOL (THREE CASE STUDIES)

6.1. Case study A

6.1.1. Subject A

In case study A the subject was a 35 year old male. The subject's height measured 174.2 centimeters and he weighed 83.8 kilograms. Subject A had been a technician for 11 years and has a reputation as a hard working, committed employee. He did not have a notable history as far as work-related injuries or absenteeism due to injury was concerned. This changed, however, when he had an accident while working on an electrification pole, causing a disabling injury.

6.1.2. Specific information on the disability

The subject fell from a ladder while descending. The subject's foot slipped at a time when his safety harness was not attached to the ladder. This caused him to tumble to the ground (a fall of approximately 2 meters). The subject tried to break the force of the impact with his right hand and arm, in the process causing a fracture to the right wrist as well as an anterior dislocation of the right shoulder. The injury was classified as a partial-temporary disability and the medical doctor applied a plaster cast to the wrist and fore-arm. The doctor also prescribed an arm sling for support and stability in the shoulder joint. Furthermore it was recommended that no physical work should be done for a period of 3 months or until the injured body parts had been successfully rehabilitated.

6.1.3. Job accommodation for subject A

After approximately 6 weeks the plaster cast could be removed and the subject could start with physical rehabilitation. After a few weeks of physiotherapy the subject could begin final phase rehabilitation with the biokineticist. At this point management requested that the subject returned to work, with accommodations, as soon as possible. The medical practitioner requested task-specific job accommodation guidelines from the relevant biokineticist. The task-specific job accommodation tool was used for the purposes of this request.

6.1.3.1. Informed consent

See annexure 7. The subject completed and signed the informed consent form, indicating a wrist injury as well as severe weakness and discomfort in the right shoulder, arm and wrist.

6.1.3.2. Physical ability test data

See annexure 8 for the completed physical ability test data form. Table 6.1 shows the data from the physical ability testing as well as the rating of the test results when compared to the cut scores. The cut scores are used to determine whether the subject "meets the minimum requirement" (M) or "does not meet the minimum requirement" (D).

Table 6.1: Test scores and ratings (M or D) for Subject A:

PHYSICAL ABILITY TEST	CUT SCORE	TEST SCORE	M or D
Back Muscle Strength (kgf)	min 77.0	85.5	**M**
Leg Muscle Strength (kgf)	min 169.2	243	**M**
Arm/Shoulder Muscle Strength (kgf)	min 72.3	40.5	D
Grip Strength – Right (kgf)	min 34.3	13.9	D
Grip Strength – Left (kgf)	min 33.3	38.4	**M**
Stamina (beats/min)	max 136	128	**M**
Trunk Muscle Endurance (reps/min)	min 13	25	**M**
Lifting strength above head (kgf)	min 26.3	DND	D
Lifting from floor – Right (kgf)	min 43.2	38	D
Lifting from floor – Left (kgf)	min 43.1	63.5	**M**
Arm adduction strength (kgf)	min 33.2	28.9	D
Shoulder endurance – Right (kgf)	min 21.5	0	D
Shoulder endurance – Left (sec)	min 19.0	30	**M**
Balance (sec)	min 1.4	6	**M**

6.1.3.3. Job accommodation mask

See annexure 9 for the completed job accommodation mask. All the tasks that would hold a physical risk for the individual had at least one red "X" in the line next to it. All the job outputs highlighted in red were not to be performed by the individual because of the high risk tasks involved in those outputs. The weightings next to all the "non-highlighted" job outputs were added together to provide an estimation of the percentage of the total job outputs that the subject would be able to perform safely.

6.1.3.4. Job accommodation report

Annexure 10 shows the completed job accommodation report for subject A. In this case the report would be handed over to the medical practitioner who requested the task-specific job accommodation recommendations from the biokineticist. The report shows that subject A could safely perform approximately 34.33% of the job outputs involved in the technician position. The following tasks could be performed safely by subject A, according to the report: 1.1.2; 1.2.2; 1.2.5; 1.7; 1.8; 1.9; 1.10; 1.11; 1.13; 2.2.4; 2.2.5; 4; 5; and 6.1.

6.1.4. Outcome of case study A

Subject A returned to work with accommodations. The mentioned medical practitioner did make use of the task-specific job accommodation recommendations to guide him in providing job accommodation guidelines for subject A. Subject A was followed-up and re-assessed after 6 weeks (by the biokineticist). During these six weeks he attended work as normal and added value to his department by assisting with certain tasks. He also followed the prescribed rehabilitation programme. The job accommodation guidelines would be adjusted every six weeks, depending on the test results and the subsequent task-specific job accommodation recommendations. This process would be repeated until the subject could return to full, unrestricted work. If one takes into consideration how much money is lost by a company due to lost man days (see literature review) it can safely be assumed that SA ELEC has saved a substantial amount of money by accommodating the individual and thus ensuring earlier return to work. Chapter 2 also makes mention of a number of other benefits to the individual and its employer in cases where job accommodation is implemented.

6.1.5. Return on investment for case study A

This return on investment analysis attempted to illustrate the potential financial value associated with the implementation of such an intervention. In this case a simple measurement of two direct cost benefits, generally associated with job accommodation, was used to illustrate some of the potential financial benefits to a company. The two measures identified were: (1) cost saving due to sick leave reduction; and (2) productivity during the period of accommodated work. The methods used for calculating these two factors were adapted from O`Donnell and Harris (1994) and Amador-Rodezno (2005). The financial return to SA ELEC was calculated by establishing the cost of implementing the intervention and subtracting that figure from the financial benefits associated with the intervention (through sick leave reduction and productivity).

6.1.5.1. Cost

A: Transport cost = kilometers traveled × cost per kilometer

= 324 × R 1.05

= R 340.20

B: Opportunity cost for biokineticist (time consumed by intervention)

= hours consumed × hourly rate

= 5 × R 74.26

= R 371.30

Total cost to company = A + B

= R 340.20 + R371.30

= <u>R 711.50</u>

(O`Donnell & Harris, 1994)

6.1.5.2. Financial benefits

6.1.5.2.1. Cost saving due to sick leave reduction

A: Period at work with accommodations (as opposed to being off sick) = 30 working days (6 weeks)

B: Salary per day for subject A = R 361.55

C: % physical work capacity of subject A = 34.33%

Cost saving due to sick leave reduction = (A × B) × C
= (30 × R 361.55) × 34.33%
= R 10 846.50 × 34.33%
= R 3 723.60

(O`Donnell & Harris, 1994; Amador-Rodezno, 2005)

6.1.5.2.2. Productivity during job accommodation period

A: Average productivity of a "fully capable employee" during the stated period
= (days × daily salary) × 2
= (30 × R 361.55) × 2
= R 21 693.00

B: % physical work capacity of subject A = 34.33%

Productivity of subject A during applicable period = A × B
= R 21 693.00 × 34.33%
= R 7 447.21

(O`Donnell & Harris, 1994)

6.1.5.2.3. Financial benefits to SA ELEC

Cost saving due to sick leave reduction	= R 3 723.60
Productivity during job accommodation period	= R 7 447.21
Total financial benefits to SA ELEC	= R 11 170.81

6.1.5.3. Financial return

Financial return associated with case study A (first 6 weeks)

= Financial benefits – Costs

= R 11 170.81 – R 711.50

= R 10 459.31

Return on investment = R 1.00 : R 15.70

6.2. Case study B

6.2.1. Subject B

In case study B the subject was a 23 year old female. The subject's height measured 165.9 centimeters and she weighed 76.7 kilograms. Subject B had been a technician for only 1 year. She was referred to the relevant biokineticist for physical conditioning (by her supervisor), seeing that she had insufficient physical work capacity for the technician position at that stage. On further investigation it was found that during earlier pre-employment assessment she did not meet the minimum physical requirements (MPR) in a number of tests. Management, however, employed subject B regardless of the recommendations. Her pre-employment test results and subsequent recommendations clearly showed that she did not meet the MPR in the following tests:

(1) cardiovascular fitness;

(2) stomach muscle endurance;

(3) arm strength;

(4) lifting strength above the head; and

(5) arm adduction strength.

On request from her supervisor the biokineticist agreed to assist subject B with a conditioning programme, but recommended that she continued work with accommodations until such time as she was sufficiently conditioned to return to full duty. It was also requested that during this time she was granted one hour per day to perform the prescribed conditioning exercises.

6.2.2. Job accommodation for subject B

The task-specific job accommodation tool was used for the purposes of gathering information before providing job accommodation recommendations to the relevant supervisor.

6.2.2.1. Informed consent

See annexure 11. The subject completed and signed the informed consent form, indicating that she had no physical conditions or illnesses that would prevent her from taking part in the full physical ability test session. She did indicate that her mother suffered from diabetes and high blood pressure. These medical conditions, however, were not present in subject B during the time of the physical ability assessment.

6.2.2.2. Physical ability test data

See annexure 12 for the completed physical ability test data form. Table 6.2 shows the data from the physical ability testing that was performed for the purposes of providing task specific-job accommodation guidelines. It also includes the rating of the test results (M or D) when compared to the cut scores.

6.2.2.3. Job accommodation mask

See annexure 13 for the completed job accommodation mask. All the tasks that would hold a physical risk for the individual had at least one red “X” in the line next to it. All the job outputs highlighted in red were not to be performed by the individual because of the high-risk tasks involved in those outputs. The weightings next to all the “non-highlighted” job outputs were added together to provide an estimation of the percentage of the total job outputs that the subject would be able to perform safely.

Table 6.2: Test scores and ratings (M or D) for Subject B:

PHYSICAL ABILITY TEST	CUT SCORES	TEST SCORE	M or D
Back Muscle Strength (kgf)	min 77.0	90	**M**
Leg Muscle Strength (kgf)	min 169.2	202.5	**M**
Arm/Shoulder Muscle Strength (kgf)	min 72.3	74.5	**M**
Grip Strength – Right (kgf)	min 34.3	39.5	**M**
Grip Strength – Left (kgf)	min 33.3	41.9	**M**
Stamina (beats/min)	max 136	164	D
Trunk Muscle Endurance (rep/min)	min 13	7	D
Lifting strength above head (kgf)	min 26.3	28.5	**M**
Lifting from floor – Right (kgf)	min 43.2	54	**M**
Lifting from floor – Left (kgf)	min 43.1	54	**M**
Arm adduction strength (kgf)	min 33.2	23.3	D
Shoulder endurance – Right (kgf)	min 21.5	25	**M**
Shoulder endurance – Left (sec)	min 19.0	25	**M**
Balance (sec)	min 1.4	8	**M**

6.2.2.4. Job accommodation report

Annexure 14 shows the completed job accommodation report for subject B. In this case the report would be handed over to the relevant supervisor. The report shows that subject B could safely perform approximately 41.29% of the job outputs involved in the technician position. The following tasks could be performed safely by subject B according to the report: 1.1.2; 1.1.3; 1.1.7; 1.1.8; 1.2; 1.3.3; 1.3.6; 1.4; 1.5.4; 1.8; 1.9; 1.10; 1.11; 1.13; 2.2.5; 3.1.1; 3.2.3; 3.3.4; 4; 5; 6.6; and 6.7.

6.2.3. Outcome of case study B

Subject B continued to go to work after the physical ability assessment, working with the recommended accommodations / task restrictions. In between she followed the prescribed conditioning programme for one hour per day (as was agreed to by her supervisor). After six weeks, since the original assessment, she was reassessed by the relevant biokineticist. The overall improvement was significant with only stomach muscle endurance and cardiovascular fitness still below the minimum physical requirements. In both these tests, however, she did show significant improvement. The satisfactory results meant that her conditioning programme could be adjusted and a more progressive programme could be prescribed. The job accommodation recommendations did not change due to the fact that her improved results did not translate into any changes on the task-specific job accommodation tool. The reason for this was that all the tasks where arm adduction strength was required (arm adduction strength was the most improved of the three "problem" attributes and was now above the minimum physical requirement) were also dependant on good cardiovascular fitness and / or good stomach muscle endurance. As a result there were no changes in the "tasks to be performed" or the "percentage of the total job outputs that could be performed safely." Her supervisor was, however, satisfied with the progress and agreed to another 6 weeks of restricted work coupled with a one hour training session every day.

Even though it is true that for the period of the intervention she could not perform all the job outputs of a technician, it has to be remembered that she was not coping with the work in the first place. At least she still contributed to the business and the business targets while bettering herself as a human asset in the mean time. The supervisor and the company have now invested in this employee and will surely reap the rewards of proper employee management in the future.

6.2.4. Return on investment for case study B

6.2.4.1. Cost

A: Transport cost = kilometers traveled × cost per kilometer

= 820 × R 1.05

= R 861.00

B: Opportunity cost for biokineticist (time consumed by intervention)

= hours consumed × hourly rate

= 12 × R 74.26

= R 891.12

Total cost to company = A + B

= R 861.00 + R891.12

= R 1 752.12

(O`Donnell & Harris, 1994)

6.2.4.2. Financial benefits

6.2.4.2.1. Cost saving due to sick leave reduction

A: Period at work with accommodations (as opposed to being off sick) = 60 working days (12 weeks)

B: Salary per day for subject B = R 361.55

C: % physical work capacity of subject B = 41.29%

Cost saving due to sick leave reduction = (A × B) × C

= (60 × R 361.55) × 41.29%

= R 21 693.00 × 41.29%

= R 8 957.04

(O`Donnell & Harris, 1994; Amador-Rodezno, 2005)

6.2.4.2.2. Productivity during job accommodation period

A: Average productivity of a "fully capable employee" during the stated period

= (days × daily salary) × 2

= (60 × R 361.55) × 2

= R 43 386.00

B: % physical work capacity of subject B = 41.29%

Productivity of subject B during applicable period = A × B

= R 43 386.00 × 41.29%

= R 17 914.08

(O`Donnell & Harris, 1994)

6.2.4.2.3. Financial benefits to SA ELEC

Cost saving due to sick leave reduction	= R 8 957.04
Productivity during job accommodation period	= R 17 914.08
Total financial benefits to SA ELEC	= R 26 871.12

6.2.4.3. Financial return

Financial return associated with case study B (first 12 weeks)

= Financial benefits – Costs

= R 26 871.12 – R 1 752.12

= R 25 119.00

Return on investment = R 1.00 : R 15.34

6.3. Case study C

6.3.1. Subject C

Subject C was a 48 year old male. The subject's height measured 183 centimeters and he weighed 89.5 kilograms. Subject C had been a technician with SA ELEC for 15 years and worked in a similar position at a South African mine for close to 10 years before joining the company. Subject C was known as a very reliable and committed worker. His personal records did not show any significant absenteeism due to injury or illness. In all previous physical ability screenings subject C performed particularly well. His physical ability records show that he is a strong individual with no apparent weaknesses as far as his test results are concerned.

6.3.2. Specific information on the disability

In 2006 subject C was involved in a serious motor vehicle accident while on duty. Due to excessive damage to his lower left leg and subsequent complications his left leg had to be amputated just below the knee. With time subject C learned to walk with a prosthesis but it was suggested that he could no longer perform the duties of a technician. This set in motion a lengthy incapacity process as, needless to say, decisions had to be made on how subject C would fit into the business in future. The injury was classified as a partial-permanent disability.

6.3.3. Job accommodation for subject C

It was decided by the incapacity panel that subject C should continue at his current place of work (with accommodations and restrictions) until such time as a further decision has been made. The medical practitioner involved in the process requested task-specific job accommodation recommendations from the applicable biokineticist to assist him in providing the relevant supervisor with clear job accommodation guidelines. Once again the task-specific job accommodation tool was used for the purposes of this request.

6.3.3.1. Informed consent

See annexure 15. The subject completed and signed the informed consent form, indicating the mentioned injury and the subsequent amputation to the left lower leg. He also made mention of high blood pressure and indicated that he was on chronic medication for this condition.

6.3.3.2. Physical ability test data

See annexure 16 for the completed physical ability test data form. Table 6.3 shows the data from the physical ability testing as well as the rating of the test results when compared to the cut scores. The cut scores are used to determine whether the subject "meets the minimum requirement" (M) or "does not meet the minimum requirement" (D) for a specific test. As could be expected, subject C had difficulty in performing tests that required coordinated movement of the left leg and it was collectively decided that he would not perform the "3 minute step test" due to the risk of falling or further injury. It was also decided that the "balance test" would not be performed since he would not be allowed to work at heights due to his disability, making the test irrelevant.

Table 6.3: Test scores and ratings (M or D) for Subject C:

PHYSICAL ABILITY TEST	CUT SCORE	TEST SCORE	M or D
Back Muscle Strength (kgf)	min 77.0	106	**M**
Leg Muscle Strength (kgf)	min 169.2	175.5	**M**
Arm/Shoulder Muscle Strength (kgf)	min 72.3	102.5	**M**
Grip Strength – Right (kgf)	min 34.3	58.2	**M**
Grip Strength – Left (kgf)	min 33.3	55.9	**M**
Stamina (beats/min)	max 136	DND	D
Trunk Muscle Endurance (rep/min)	min 13	17	**M**
Lifting strength above head (kgf)	min 26.3	39	**M**
Lifting from floor – Right (kgf)	min 43.2	65	**M**
Lifting from floor – Left (kgf)	min 43.1	51.5	**M**
Arm adduction strength (kgf)	min 33.2	44.4	**M**
Shoulder endurance – Right (kgf)	min 21.5	37	**M**
Shoulder endurance – Left (sec)	min 19.0	40	**M**
Balance (sec)	min 1.4	DND	D

6.3.3.3. Job accommodation mask

See annexure 17 for the completed job accommodation mask. All the tasks that would hold a physical risk for the individual had at least one red "X" in the line next to it. All the job outputs highlighted in red were not to be performed by the individual because of the high risk tasks involved in those outputs. The weightings next to all the "non-highlighted" job outputs were added together to provide an estimation of the percentage of the total job outputs that the subject would be able to perform safely.

6.3.3.4. Job accommodation report

Annexure 18 shows the completed job accommodation report for subject C. In this case the report would be handed over to the medical practitioner who requested the task-specific job accommodation recommendations from the biokineticist. The report shows that subject C could safely perform approximately 37.16% of the job outputs involved in the technician position. The following tasks could be performed safely by subject C according to the report: 1.1.2; 1.1.3; 1.1.7; 1.1.8; 1.2; 1.3.6; 1.4.6; 1.4.7; 1.8; 1.9; 1.10; 1.11; 1.13; 2.2.5; 3.1.2; 3.1.3; 3.2.3; 4; 5; 6.1; and 6.2.

6.3.4. Outcome of case study C

Subject C temporarily returned to work with accommodations. The mentioned medical practitioner did make use of the task-specific job accommodation recommendations to guide him in providing job accommodation guidelines for subject C. This arrangement continued for 4 weeks, in which time Subject C contributed within the job accommodation guidelines on a daily basis. After 4 weeks the incapacity panel reached a decision. They decided that Subject C would not be allowed to return to full duty as a technician due to the high risk of performing certain tasks with a prosthesis and because company guidelines stated that a permanent disability (period longer than twelve months) could only be accommodated on a permanent basis if the subject could perform at least 60% of the critical tasks related to that position. As a result they offered him a non-physical position in a different department, which he accepted. Even though Subject C only worked with accommodations for a period of 4 weeks, the company and the individual did benefit from the intervention. Value was added to the business, lost man days were minimised and Subject C got the opportunity to prove his continued worth to himself, his colleagues and his employer.

6.3.5. Return on investment for case study C

6.3.5.1. Cost

A: Transport cost = kilometers traveled × cost per kilometer
= 273 × R 1.05
= R 286.65

B: Opportunity cost for biokineticist (time consumed by intervention)
= hours consumed × hourly rate
= 5 × R 74.26
= R 371.30

Total cost to company = A + B
= R 286.65 + R371.30
= <u>R 657.95</u>

(O`Donnell & Harris, 1994)

6.3.5.2. Financial benefits

6.3.5.2.1. Cost saving due to sick leave reduction

A: Period at work with accommodations (as opposed to being off sick) = 20 working days (4 weeks)

B: Salary per day for subject C = R 361.55

C: % physical work capacity of subject C = 37.16%

Cost saving due to sick leave reduction = (A × B) × C

= (20 × R 361.55) × 37.16%

= R 7 231.00 × 37.16%

= R 2 687.04

(O`Donnell & Harris, 1994; Amador-Rodezno, 2005)

6.3.5.2.2. Productivity during job accommodation period

A: Average productivity of a "fully capable employee" during the stated period

= (days × daily salary) × 2

= (20 × R 361.55) × 2

= R 14 462.00

B: % physical work capacity of subject C = 37.16%

Productivity of subject C during applicable period = A × B

= R 14 462.00 × 37.16%

= R 5 374.08

(O`Donnell & Harris, 1994)

6.3.5.2.3. Financial benefits to SA ELEC

Cost saving due to sick leave reduction	= R 2 687.04
Productivity during job accommodation period	= R 5 374.08
Total financial benefits to SA ELEC	= R 8 061.12

6.3.5.3. Financial return

Financial return associated with case study C (4 weeks)

= Financial benefits – Costs

= R 8 061.12 – R 657.95

= R 7 403.17

Return on investment = R 1.00 : R 12.25

CHAPTER 7:
SUMMARY, CONCLUSION, AND RECOMMENDATIONS

7.1. Introduction

This study was a natural follow-up from a previous study entitled: "Minimum Physical Requirements for the Physical Workers of an Electricity Supply Company by way of Work-Specific Physical Assessments" (Bester, 2003). The focus shifted to addressing the question of how to manage an employee who is physically unable to perform physically-demanding tasks due to disability or insufficient physical ability. Job accommodation has always been seen as a popular and effective approach to the management of such employees, allowing them to work and be productive during this period of injury, illness or incapacity. The specific aim of this study was to develop a tool to assist the relevant parties in implementing task-specific job accommodation guidelines for physically-demanding positions, as opposed to the general guidelines usually provided. In other words, it attempted to fill the gap that usually exists between the physical condition of an employee (medical information and terminology) and the actual physically-demanding tasks. The final product is capable of clearly indicating which tasks may or may not be performed. It also provides an indication of the percentage of the total work outputs that an employee will be able to perform without risk to himself / herself and his / her co-workers.

7.2. Summary

7.2.1. Summary of the literature review

The literature review focused on ten different topics, all very much related to job accommodation as an intervention, the development of the task-specific job accommodation tool, the different factors involved in the implementation of it, the possible uses and the possible value of implementing such a tool.

7.2.1.1. Physical ability testing (PAT) for physically demanding work

Physical ability testing (PAT) is a tool used to assess an individual's physical abilities to perform specific work-related physically-demanding tasks. It is the preferred ergonomic approach for those physically-demanding jobs that cannot be redesigned. The goal is to match the worker's physiological capabilities to the physical demands of the job (Bester, 2003; Arvey, 2005). McKenney (2000) describes this as a comprehensive, objective test of an individual's ability to perform work-related tasks. Serra *et al.* (2007) states that the assessment of fitness for work is defined by most as the evaluation of a worker's capacity to work without risk to his own or others' health and safety. Importantly, McKenney (2000) also states that only trained health professionals with extensive training in anatomy, physiology, kinesiology, and the effects of disease/injury and exercise on the human body, should administer such tests.

The ever-rising incidence of disability among the worldwide working population is a matter of great concern (Chavalinitikul *et al.*, 1995; Van Niftrik, 1996). Extremely large amounts of money are lost every year due to workers' compensation claims (Lukes & Bratcher, 1990; Malan & Kroon, 1992; Greenberg & Bello, 1996). Strong evidence suggests that the physical demands of work is a risk factor for the incidence of lower back pain (Burton, 1997; Waddell, 1998; Waddell & Burton, 2001). All and all there are a number of well-documented benefits associated with PAT. The main benefits of matching the work and the worker include injury prevention, decreased re-injury rates, decreased (employee) turnover and improved production (Mamansari & Salokhe, 1996; McKenney, 2000).

In order to ensure proper and effective implementation of PAT in any physically-demanding job, there are a number of very important considerations that one has to adhere to. Firstly it is critical that a thorough job analysis is done (Keyserling *et al.*, 1990; Isernhagen, 2000a; Toeppen-Sprigg, 2000; Janowitz *et al.*, 2006). Furthermore, it is very important to develop a test battery that is safe, valid, reliable, objective, credible, and standardized (Shrey & Lacerte, 1997).

7.2.1.2. Important physiological components involved in physical ability testing

This section looks at the physiological components involved in physical ability testing. The following components are discussed in depth, because of their critical importance during physical ability testing and because of their great relevance in terms of this thesis: muscular strength; muscular endurance; flexibility; cardiovascular fitness; and balance. Due to the natural onset of muscle fatigue following physical activity, muscle fatigue is also discussed.

7.2.1.3. Job analysis

Without knowledge of the critical physical demands of a job, a therapist is unable to establish an appropriate work-related rehab programme and, therefore, cannot determine when an injured worker can safely and productively return to work (McKenney, 2000). Arvey (2005) states that the first step in physical ability testing is to assess the physical demands of work through careful job analysis. Information on job demands can be used to devise functional capacity evaluations or work hardening, and to assess fitness for duty (Halpern *et al.*, 2001). An important question is: "How are job demands assessed?" (Toeppen-Sprigg, 2000).

One of the first things to think about is how one will identify those tasks that will be simulated by the physical assessments. In other words, to determine which physical tasks have to be performed successfully in order to be successful in the specific job and the measurability of these tasks (Shrey & Lacerte, 1997; Fine & Cronshaw, 1999; Bester, 2003). A number of methods and approaches that apply to the analysis of jobs and their ability requirements are well-documented and discussed. These include: (1) questionnaires; (2) interviews; (3) job descriptions; (4) videotapes; (5) jobsite assessments; and (6) observation (Fleishman, 1979; Magill, 1993; Shrey & Lacerte, 1997; Meier, 1998; Isernhagen, 2000a; Toeppen-Sprigg; 2000; Halpern *et al*., 2001; Bester, 2003; Janowitz *et al*., 2006).

7.2.1.4. Identifying the test battery for physical ability testing

When one starts to look at all the research done on job-related physical assessments, for whatever purpose, the immediate realization is that the options are vast. A major approach to the selection of personnel for physically-demanding jobs focuses on strength requirements. Much of the original work in this area has been spearheaded by Chaffin (1974), Park and Chaffin (1975), Chaffin *et al.* (1977), Chaffin *et al.* (1978), Herrin and Chaffin (1978) and Keyserling *et al.* (1980a).

A pivotal issue is a compatible match between what the worker can do physically and what the job is demanding (Isernhagen, 2001). After years of research, Fleishman (1979) identified nine basic abilities which were found to be useful in describing hundreds of separate physical performances that were researched by him. It is these nine abilities which can be used to evaluate the physical abilities required in new jobs and it is these nine abilities which provide a basis for selecting tests to measure each of the separate abilities. There are two unique aspects about this approach. Firstly, this assessment approach attempts to measure a wide variety of physical abilities, including endurance (stamina), many types of strength, and measures of flexibility, co-ordination and balance (Jackson, 1994). Secondly, the tests that measure these abilities require little instrumentation or administration training. These features may make Fleishman's approach potentially useful in applied settings (Campion, 1983).

A number of methods for measuring strength have been developed to allow the matching of muscular capabilities of workers with the force requirements of a particular job. A variety of methods are available for the assessment of human strength. The techniques utilize one of three categories of muscle contractions: isometric, isotonic or isokinetic. Isometric muscle contractions are static and involve no movement. Isotonic muscle contractions are dynamic and do involve movement of the limb. Isokinetic exercise also involves movement, but the speed and sometimes the displacement of the movement is controlled or held constant (Campion, 1983; Shrey & Lacerte, 1997; Krüger & Jansen van Vuuren, 1998). Luk *et al.* (2003) suggests that isometric and isokinetic work modes should be used to evaluate lifting strength. Schonstein and Kenny (2001) also mentions that isokinetic equipment can be used to measure work capacity.

Most studies found that one or two physical-ability measures (e.g. arm strength) could adequately predict the criteria by themselves. However, a strong argument can be made to include additional predictors, even if they do not add substantially to the validity. One reason is that multiple predictors may result in a more reliable battery. But perhaps a more important reason is that using multiple predictors may enhance the content validity of the selection system (Campion, 1983). Most physically-demanding jobs probably require some amount of both strength and endurance, thus measures of both should be included in the predictor set (Hough *et al.*, 2001). Documenting both content and criterion-related validity may be a wise strategy, especially given the potential adverse impact of physical ability selection systems (Campion, 1983; Jackson, 1994).

It is clear that there are a number of very important considerations as far as test battery selection is concerned. Literature reports a number of criteria when selecting a test battery for physical ability testing. These include that:

(1) it should meet all the legal requirements (Meier, 1998);
(2) it should correspond with the critical physical requirements of the job (Malan, 1992; Meier, 1998; Harley & James, 2006);
(3) it should give a clear indication of the person's physical ability to perform the critical physical requirements of the job (Meier, 1998);
(4) it should be cost effective and easy to implement (Meier, 1998; Janowitz *et al.*, 2006);
(5) it should be appropriate for use in settings where confidentiality and privacy demand is critical (Janowitz *et al.*, 2006);
(6) it should be adaptable to heterogeneous environments / jobs (Janowitz *et al.*, 2006);
(7) it should be as unintrusive as possible (Janowitz *et al.*, 2006);
(8) it should be objective and quantitative (Bester & Krüger, 2004);
(9) it should be valid and reliable (Shrey & Lacerte, 1997; Bester & Krüger, 2004);

(10) it should test the critical movements and exertions as closely as possible (Bester & Krüger, 2004); and

(11) it should assess a wide variety of physical abilities (Malan, 1992).

7.2.1.5. Calculating minimum physical requirements (MPR) or "cut-off scores"

Cut-off scores are often used in conjunction with strength tests and they are usually set to approximate the maximum (or near-maximum) requirements of the job. In other words, the minimum physical ability that an individual should possess. Biddle and Sill (1999) discusses a number of approaches to determining a cut-off score. The cut-off score is the test score that an applicant must obtain to be considered for a job (Jackson, 1994; Biddle & Sill, 1999; Bester, 2003). It is critical that persons being employed not only show the ability to do the job safely and effectively, but also have the ability to be trained further, especially in occupations such as the police force, where further training is of the utmost importance (Meier, 1998).

The consensus in the professional literature is that there is no single method of determining a cut score that is optimal in all situations. The decision of where to set a cut score for a physical ability test should be a business decision that depends not only upon the available labour pool, but also other factors such as desired levels of work productivity, worker safety and level of adverse impact (Jackson, 1994). A certain level of physical strength is required in order to perform certain tasks and an inability to operate heavy tools and handle heavy equipment will not only be dangerous, but it would also make the performance of certain key duties impossible. The same tests would, however, have absolutely no relevance when screening potential office clerks, for example, as physical strength cannot impact on the inherent requirements of the position, nor does a lack of physical strength hold any risk to his / her own or others' health and safety (Botha *et al.*, 1998; Hankey, 2001; Bester, 2003).

Occupational health professionals have a significant role to play in the selection of suitable employees (Hogan & Quigley, 1986; Botha *et al.*, 1998; Bester, 2003). It is, however, important to note that this can have serious legal implications and the Labour

Relations Act, No. 66 of 1995, as well as the Employment Equity Act, No. 55 of 1998, looks closely at this.

7.2.1.6. Women in physically-demanding positions

With the advent of so many women entering what had been traditionally male-dominated occupations came the development of entry level tests (Washburn & Safrit, 1982; Davis & Dotson, 1987; Bester, 2003). The initial and majority of legal cases concerning pre-employment testing involved racial and ethnic discrimination by paper and pencil cognitive tests (Arvey & Faley, 1988), but with the increasing interest of women seeking physically-demanding jobs, the litigation of cases concerning physical requirements has increased (Washburn & Safrit, 1982; Jackson, 1994). A major source of this gender discrimination litigation has been with public safety jobs, police officer-, fire fighter- and correctional officer jobs (Jackson, 1994). As a result of women now accounting for a larger percentage of the active, traditionally male-dominated workforce, there are now also more women in occupations that historically have had higher injury rates (Kelsh & Sahl, 1996). According to Björkstén *et al.* (2001), it is well known that musculoskeletal problems are common among female industrial workers, especially when they are still unskilled. For example, Rice *et al.* (2007) states that musculoskeletal injury among army health care specialist students have been reported to be approximately 24% for men and 24-30% for women.

All and all the work done by Kelsh and Sahl (1996) seems to indicate that men and women who do the same physically-demanding work more or less suffer from the same injuries, or at least that the body parts are more or less affected equally. However, it also seems to be the case that women suffer more injuries (higher injury rate) than their male colleagues. Cherry *et al.* (2001) supports this finding by stating that in most occupations, and overall, women are at greater risk for musculoskeletal conditions than men. Furthermore, Smith and Mustard (2004) states that women in manual occupations have more than twice the risk of chronic musculoskeletal injuries compared to men. One reason for this may be a lack of sufficient physical ability. Factors that are often mentioned, which may affect a woman's successful performance on the job, include upper body strength, endurance, physical conditioning and the ability to operate power tools (Shuster, 2000).

7.2.1.7. Ageing workers in physically demanding positions

The ageing of the population is both a great challenge and a threat for most modern societies all over the world. Ageing affects both the workforce and the retired population (Savinainen *et al.*, 2004). Over recent years, the study of ageing and work has attracted growing attention in scientific literature as a direct consequence of demographic changes in the age structure of the workforce in many industrialized countries (de Zwart *et al.*, 1995; Larson, 2001). US workers, for example, will not only remain in the workforce for more years than expected, they will also be working in organizations that will press them to be more productive. Trying to meet increasing productivity requirements usually contributes to worker injuries, especially amongst middle-aged and older workers (Freeman, 2004).

In the literature, a progressive decline in physical work capacity, characterised by diminished aerobic capacity and muscular capacity, has consistently been reported amongst ageing workers (de Zwart *et al.*, 1995). Decline in muscular strength during ageing has been a matter of scientific interest since Quetelet did a pioneering study in 1836. In more recent studies, maximal strength has been reported to reach its peak at the age of 25 – 35 years, to show a slow or imperceptible decrease into the forties, and then an accelerated decline (Viitasalo, 1985). In the post-40-year category, physical fitness begins to decrease and may impair work capacity and performance, particularly in physically-demanding blue-collar jobs (Louhevaara, 1999). Schibye (2001) reports that aerobic power and muscle strength normally decreases with age. Larson (2001) states that the older worker experiences physical, neurological and sensory changes throughout the normal ageing process. The results may include loss of muscle strength, loss of joint flexibility, decreased reaction time, decreased speed of movement, postural changes, decreased balance control and changes in vision and hearing. For many older individuals, conditions such as arthritis, diabetes or heart disease add to the effects of the normal ageing process. These physical, neurological, sensory and / or pathological changes may affect the older worker's safety and productivity in the workplace (Coy & Davenport, 1991).

7.2.1.8. Occupational injuries in physically-demanding positions

Occupational injuries are responsible for a significant proportion of worker absenteeism and disability (Swaen *et al.*, 2003). Costs associated with work-related disorders are difficult to measure. Direct costs include medical bills, worker's compensation premiums, and the costs of replacement workers. Indirect costs may include loss of production, total temporary disability costs and litigation (Olson, 1999). The incidence of occupational accidents varies greatly from occupation to occupation and from industry sector to industry sector (Swaen *et al.*, 2003), but since the injury rates for physically-demanding positions tend to be generally higher than in non-physical occupations, one can safely assume that more occupational accidents occur in physically-demanding positions (Craig *et al.*, 1998). McGwin Junior *et al.* (2005) supports this statement by stating that in their study, the most common mechanisms of injury were falls from height (41%), burns (18%) and electrical injuries (15%). Fractures, burns and closed head injuries were the most common injuries in their study.

What are the primary causes of such accidents? According to Swaen *et al.* (2003), their study provides evidence that both fatigue and need for recovery are independent risk factors for being injured in an occupational accident. This is a very relevant finding in the context of this thesis. McGwin Junior *et al.* (2005) focused their study on the performing of unusual job activities as a risk factor for occupational injuries. They found that a highly-elevated risk of injury was associated with the performance of an unusual job task. Hertz and Emmett (1986), as well as Sorock *et al.* (2004), found significant associations between unusual job tasks and hand injuries. Saari and Lahtela (1981) reported that, in studies of three industries in Finland, more than half the injuries occurred in the course of tasks performed less than once per day. Fabiano *et al.* (2001) states that more consideration should be given to the work environment, to the improvement of the man-machine interface, and to human and organisational factors.

Legge and Burgess-Limerick (2007) agrees with Swaen *et al.* (2003) by stating that functional assessment, which includes tests of aerobic physical fitness, balance, postural tolerances and material handling tolerances, is increasing in popularity as a preventative tool for controlling sprains and strains in the workplace. Rosenblum and Shankar (2006) states that employees, having been effectively matched to the physical demands of their jobs, may be at significantly lesser risk of injury and disability from both musculoskeletal and non-musculoskeletal disorders.

7.2.1.9. Job accommodation – what is job accommodation?

Job accommodation can be defined as a pro-active, employer-based approach to:
(a) prevent and limit disability;
(b) provide early intervention for health and disability risk factors; and
(c) foster coordinated disability management, administrative and rehabilitative strategies to promote cost-effective restoration and return to work (Williams & Westmorland, 2002).

Halpern (2003) gives the following definition for job accommodation: "In the context of return to work, accommodations are interventions that reduce the duration, frequency and / or magnitude of exposure to occupational risk factors." Williams and Westmorland (2002) states that modified work can involve modifications or adjustments of the original job to reduce physical demands or hours worked. It is also critical to emphasise that, during the return-to-work process, the physical demands of work and the functional / physical capacity of the worker must be continually matched (Isernhagen, 2000b).

The literature makes mention of different approaches to job accommodations. It is also important to note that more than one of these accommodations could be implemented at the same time (Bates, 1999; Campolieti, 2005). Following are a few types of accommodations mentioned in the literature:
(1) flexible work schedules (Bates, 1999; Unger & Kregel, 2003; Campolieti, 2005);
(2) reduced hours (Bates, 1999; Campolieti, 2005);
(3) task reduction (Bates, 1999 Isernhagen, 2000a; Unger & Kregel, 2003);

(4) modified equipment (Bates, 1999; Campolieti, 2005);
(5) special training (Unger & Kregel, 2003; Campolieti, 2005);
(6) modified workstations or work areas (Unger & Kregel, 2003; Campolieti, 2005); and
(7) light duties (Bates, 1999; Isernhagen, 2000a; Campolieti, 2005).

7.2.1.10. Job accommodation – why implement job accommodation?

Lost work days, also referred to as "man days", are a constant and major concern for any company (Isernhagen, 2000a; Schonstein & Kenny, 2001). This could be brought about by a number of reasons, ranging from sick leave abuse to a lack of required physical ability, to temporary-, or permanent physical impairment and disability (Schonstein & Kenny, 2001; Williams & Westmorland, 2002; Westmorland & Buys, 2004). According to Helm *et al.* (1999), workers who are injured on the job are often labeled permanently restricted by their physicians and are then deemed permanently disabled by their employers.

Throughout the world, including South Africa, various approaches have been identified and implemented in an attempt to ensure that employees in physically-demanding positions are properly managed from a physical work capacity point of view (Carmean, 1998; Helm *et al.*, 1999; Isernhagen, 2001; Schonstein & Kenny, 2001; Tuckwell *et al.*, 2002). One such approach is job- or workplace accommodation which will allow qualified individuals to perform essential job functions despite their physical limitations or disabilities (Schartz *et al.*, 2006).

Job accommodation could be seen as a primary job retention intervention and have shown to be effective in extending working life, including that of older workers (Allaire *et al.*, 2003). Schartz *et al.* (2006) further states that the concept of reasonable workplace accommodation is central to non-discrimination and the Americans with Disabilities Act actually prohibits employers from discriminating against qualified individuals with disabilities in hiring, retention, promotion or termination, unless the accommodations would impose undue hardship for the business. This, in turn, is also in line with the Labour Relations Act, No. 66 of 1995 and the Employment Equity Act, No. 55 of 1998 in

South Africa, both of which define unfair labor practice to include discrimination on the grounds of disability, but with the clear statement that unfair discrimination excludes discrimination based on the inherent requirement of a job (Labor Relations Act 66, 1995; Botha *et al.*, 1998; Employment Equity Act 55, 1998).

7.2.2. Summary of the course of this study

The long road to the final product included a number of steps that had to be followed. Some of these steps required a great deal of time and energy, as the researcher attempted to develop a tool that is accurate and scientific, yet practical and value adding. The researcher considers this process to be just as valuable as the final product, seeing that the process may guide future users and researchers when attempting to develop a comprehensive job accommodation tool. Following is the process that was followed during this study, shortly describing all the steps involved:

(1) literature review;

(2) identify a physically-demanding position to be used for the purposes of the study (in this case, a technician position at SA ELEC was used);

(3) identify the physical ability test battery for the technician position (the existing physical ability test battery for the technician position was used. See chapter 3 for the process followed to develop the test battery);

(4) determine the minimum physical requirements for each test (the existing minimum physical requirements for the technician position was used. See chapter 3 for the process followed to calculate the minimum physical requirements);

(5) break the official job outputs down into smaller, critical tasks (through a proper job-analysis approach);

(6) determine which tests are applicable to which tasks, through the critical physical demands (task observation, video analysis, task performance, practical experience from experts in the field of the technician position, and professional opinion from the researcher and a physical work capacity expert was utilized);

(7) determine the weighting of each job output by looking at the frequency, duration, and importance of each output in everyday work (information was gathered through 84 interviews with technicians and their supervisors. This information was used to

develop a procedure for calculating the percentage of the total work outputs a person will be able to perform); and

(8) finalising the task-specific job accommodation tool with applicable documentation (see chapter 4).

Once the finished task-specific job accommodation tool and all the related documentation were in place, the researcher made use of three totally independent case studies to demonstrate how the tool is to be implemented. Furthermore, the three case studies were used to point out the possible value and benefits of implementing such a tool.

7.3. Conclusion

7.3.1. The goal, the objectives, and the hypothesis

In order to conclude whether this study has achieved its goal and objectives, one has to glimpse back at the goal and the related objectives that were set before the study started. In this light, the researcher is indeed satisfied that the goal and all the objectives have been met, and that the manner in which these goals and objectives were achieved represents high-quality, scientifically-correct research. The goal was to ***"develop a task-specific job accommodation tool for a physically-demanding position"*** and this was indeed achieved, as can be seen in chapters 3, 4, 5 and 6. Following is a short description of the objectives that were achieved along the way:

- building a theoretical frame of reference on existing literature, with specific focus on topics such as physical ability testing, norm calculation, job analysis and job accommodation (chapters 1 and 2);
- identification of the physically-demanding position to be used as example during the course of this study (chapters 1 and 3);
- description of the outputs and critical physical demands associated with the identified position (including the job analysis) (chapters 3 and 4);
- identification and description of a test battery that will be suitable in assessing the critical physical demands of the mentioned position (chapter 3);
- description of the calculation of the minimum physical requirements for the mentioned position (chapter 3);

- step by step description of the process in developing the actual task-specific job accommodation tool (chapter 4); and
- instructions on the implementation of the job accommodation tool (chapters 5 and 6).

When looking at the research hypothesis, the researcher feels confident that the main hypothesis has definitely been proven. The hypothesis reads as follows: ***"Physical ability tests can be used to develop a task-specific job accommodation tool for a physically-demanding position."*** Whether the same can be said about the sub-hypothesis is open for debate and the proof of it probably lies beyond the reach of this thesis. The researcher is, however, extremely confident that the "sub-hypothesis" is a definite by-product of the study. This statement is based on the extensive literature review that was conducted, which did not produce anything similar to the final product of this study, namely "the task-specific job accommodation tool". This indeed leads one to the conclusion that ***"the mentioned job accommodation tool will contribute in developing the field of corporate biokinetics, specifically related to jobs where physical ability is an inherent requirement of the job"*** (the sub-hypothesis).

7.3.2. The task-specific job accommodation tool

Chapter 5 places all the focus on the final product and provides guidelines on the implementation of it. The completed task-specific job accommodation tool seemed to be easy to implement and it provided the anticipated information and guidelines regarding job accommodation in the applicable physically-demanding position. Chapter 6, however, would reveal more about the use and the value of the tool, especially in the practical and financial sense of the word.

In chapter 6, the researcher reported on three separate case studies where the job accommodation tool had been implemented during periods when employees could not perform their normal daily outputs. The purpose of this chapter was to show how the tool is to be implemented and to indicate certain benefits. The researcher was very pleased with the implementation of the tool and with the acquired results. The return on investment results were of particular significance, as these figures provided concrete proof of the value that such a tool could add. According to the calculations, each of the three case studies provided a return on investment ratio of above R12.00 for every one rand spent during the intervention. The total financial return for the three case studies added up to R42 981.48. This is money that would have been written off, were it not for the job accommodation intervention. This can safely be assumed, since each of the mentioned employees would have been on sick leave and not able to contribute in any shape or form during the applicable periods.

It is also important to note that the calculations only paid attention to two possible benefits, namely: (1) cost saving due to sick-leave reduction; and (2) productivity during the period of accommodated work. When one looks at the bigger picture, other possible benefits of such an intervention that could add to the financial return would include: (1) reduction in employee turn-over due to employee retention; (2) reduction in ill-health retirement and worker’s compensation; (3) reduction in cost of training for a new employee; and (4) reduction in the disruption of work performed by other employees. If added to the equations, each of these points could add considerably to the financial returns. Another factor that should be remembered is that the financial return for each of the case studies was measured over a relatively short period and that the final amounts could be considerably larger.

The development and implementation of the task-specific job accommodation tool revealed a number of very important characteristics about it. The researcher divided these characteristics into strong points and weak points. Following here are the most important strong points of the final product:

(1) the tool is inexpensive to develop and to implement;

(2) the development process can be generalised to any physically-demanding position;

(3) the final product is very easy to implement;

(4) it is easy to measure and indicate progress;

(5) the gap between science and the actual work tasks are bridged successfully;

(6) there is no room for subjective interpretation and subsequent mistakes;

(7) the recommendations are straightforward and easy to implement;

(8) the reports are self-explanatory and easy to understand;

(9) it is easy to calculate financial returns, due to the physical work capacity percentages provided;

(10) the results are extremely relevant to the applicable job and its work tasks; and

(11) since the process of implementation is totally objective and logic, the chances for misunderstandings are limited.

It is clear that the benefits of implementation would be substantial. The researcher would however also like to point out a few weak points that were identified through the process of development and implementation. Addressing these characteristics would definitely improve the final product and its value:

(1) the development of the tool is time consuming;

(2) the implementation process is time consuming;

(3) the physical work capacity percentage provided is difficult to influence through improved physical ability, due to the fact that the work outputs are used to calculate this percentage and not the specific tasks;

(4) the physical ability tests may pose a risk of further injury to the affected employee;

(5) the physical ability tests are dependent on effort and therefore the results could be manipulated by the employee; and

(6) in cases where an injured employee has to be assessed, the employee may not be able to perform a number of tests and this will influence the effectiveness of the tool.

7.4. Recommendations

Although the final product seems to be a very comprehensive tool in providing task-specific job accommodation guidelines, there is always room for improvement and opportunity for further research. Following here are a few recommendations.

When looking at the criterion validity of the task-specific job accommodation tool, preliminary evidence of concurrent validity was observed during the three case studies. This statement is based on the fact that none of the three subjects were capable of performing their jobs to a satisfactory level to start with (hence they were referred to the occupational health team) and this finding was clearly reflected in their initial job accommodation reports. The three reports showed that not one of the subjects were capable of performing more than 41.29% of their job outputs safely. The three reports also showed that each of the subjects would have had difficulty in performing a great number of critical tasks. As far as the predictive validity of the tool was concerned, this would need to be improved upon through follow-up studies, since its predictive properties and the possible long-term value of its implementation cannot be evaluated at this point. It is important to note that, even though such a research project clearly fell beyond the scope of this study, improving the predictive validity through future research would definitely add to the value of the tool.

Just as this thesis was a natural progression from existing research, the researcher strongly hopes that future projects would be born from it. Job accommodation (as is the case with a number of related topics) is still in its infant shoes and the value that could be added by the implementation of comprehensive, well-researched job accommodation tools cannot be denied. This thesis focused only on physically-demanding work, but one can scarcely think of a single job where job accommodation would not have a role to play in some form or shape. Here follows a number of suggestions for future research projects that would certainly contribute to the applicable literature pool:

(1) the long-term value of implementing the task-specific job accommodation tool that was developed during this study;
(2) additional and / or improved approaches to task-specific job accommodation;
(3) additional and / or improved approaches to calculating the weight of tasks or outputs;
(4) additional and / or improved approaches to calculating the percentage of the job that a person is capable of performing;
(5) adapting the development process used during this study to other jobs and measuring the effectiveness of the final product;

(6) comparing injury rates, turn-over rates, overall productivity and sick leave of companies with a proper job accommodation programme to that of companies without such a program;
(7) assessing the validity and reliability of the task-specific job accommodation tool from this study; and
(8) investigating the different approaches to job accommodation being used in South African companies.

The researcher has no doubt that SA ELEC would benefit greatly from the task-specific job accommodation tool. SA ELEC has a number of different physically-demanding positions and close to half of the company's employees work in these positions. This is proof of the scope that exists and, if the three case studies are anything to go by, this new development could save the company millions in the long run and all involved could benefit massively from its implementation. It could also greatly assist other role players, as managers, supervisors, human resources practitioners and other health professionals could gain valuable insight and assistance from task-specific job accommodation reports. For now, however, there is undoubtedly a lot of hard work to be done, not only to perfect the product, but also to develop such a tool for every single physically-demanding position in SA ELEC. Once this is in place, a vital cog that has been missing up to now will undoubtedly ensure that the entire machine runs stronger and smoother in the years to come.