GB Wheelchair Basketball Strength & Conditioning Philosophy Document – V.1.0

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Purpose

The purpose of this document is to provide guidance to individuals who are involved in the provision of strength and conditioning (S&C) to wheelchair basketball players. The underlying aims are:

i. To summarise the training philosophy of GB WCB as directed by the Snr S&C Coach. As such this provides a clear direction which should be taken when working with GB players (Men, Women and Jnrs).

ii. To provide a single, concise resource which applies up-to-date and scientific training principles to the sport of wheelchair basketball (previously this has not existed).

The varied nature of disability, training age, body type, etc, within the sport dictate that training programmes must be highly varied and individualized in order to be effective. As such, this document will place a greater focus on underlying principles and philosophies than absolutes.

Contents

1.0 Needs Analysis.

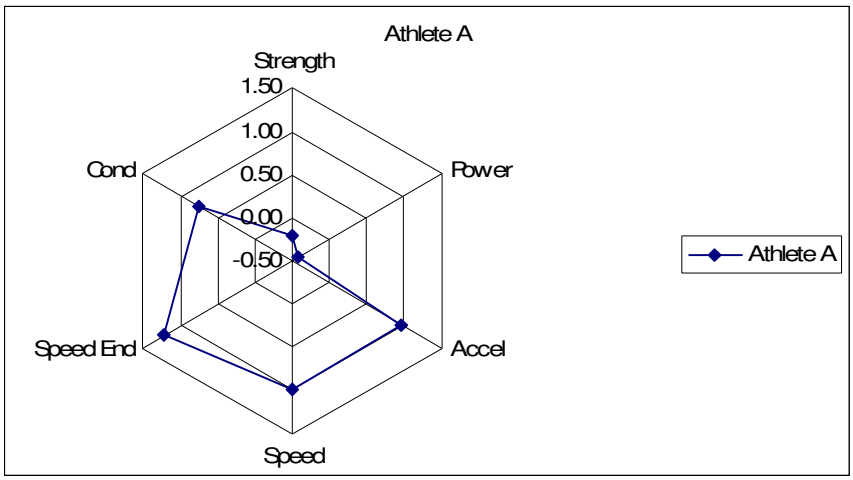
Wheelchair Basketball is a multi-faceted sport which requires a broad range of physical attributes. These include skill, speed, strength, power, conditioning and function. Consequently an individual is unlikely to reach their genetic potential in a single quality unless it is to the detriment of others. Therefore the goal of the S&C coach is to assess the player's ability in each area and make a judgement as to where the greatest potential for performance enhancement lies.

This type of holistic approach is critical if the player is to maximize the benefits of S&C. S&C coaches should ensure that all work included in a programme can be justified over another element of training if challenged. Historically, S&C coaches have placed too great an emphasis on strength alone and ignored other aspects such as speed and conditioning.

Input should always be sought from the relevant WCB coach as to where they believe the player needs to develop (either directly or through Snr S&C coach). This will enhance the likelihood of S&C training being directed correctly and thus impacting positively on performance.

In addition to this, GB Snr Men are also provided with a player profile which illustrates how they compare in each attribute with the rest of the squad (see fig 1.0). This should be used as a key element of the player's needs analysis and the direction of training. However it must also be considered that the disability of the athlete may present them with a predisposition towards weakness in a particular area in comparison with squad means.

Figure 1.0 – Player Profile Graph



Note: Axis represents number of std devs from the mean. Qualities are measured by; strength – dips/bw.kg, power – fast bench/bw.kg, acceleration – static 5m sprint, speed – time to complete 1 rep of repeated sprint test, Speed endurance – total time to complete repeated sprints test, conditioning – bleep test.

2.0 Injury Prevention.

A key objective of any strength and conditioning programme should be to minimize the risk of injury. The concept of long-term athlete development is underpinned by year-on-year progression. For this to happen effectively it is important that training is not continually disrupted and set back by injury.

Wheelchair Basketball players are highly susceptible to overuse injuries and movement dysfunctions of the shoulder girdle and upper limb. This problem may be magnified in players who are habitual chair users.

The GBWBA S&C approach to dealing with this issue has 3 main areas of address:

1. Corrective Exercise Programmes
2. Movement quality based warm-ups
3. Training Load Monitoring

2.1 Corrective Exercise Programmes

These should be considered a cornerstone of a player's physical preparation. Corrective exercise work will generally be prescribed and performed in 3 settings:

1. Physio prescribed exercises aimed at correcting previously identified issues.

   These will generally be the result of previous injury and/or pain symptoms. However they may also be focused on addressing a movement dysfunction identified in a movement screen.

2. Generic prehab routines prescribed on a monthly basis by Snr S&C coach to be performed 3-4 times per week away from training.

These routines are not individualized but are aimed at general shoulder health and common movement dysfunctions seen in this population. If an athlete has been given a corrective exercise programme to address a specific issue then that should take precedence over the generic routine.

3. Prehab movements which are included as part of an S&C session with the intention of improving movement quality which supports strength development. This environment may provide an opportunity to incorporate improved muscle function into compound movements following isolated activation type exercises.

Each player should undergo an assessment of their shoulder function prior to commencing an S&C programme. Where possible this should be performed in conjunction with a physiotherapist. Whilst all programmes should be based on the needs analysis of the individual, described below are some of the most common areas of priority:

- Shoulder Mobility (through extension)
- Thoracic mobility (extension and rotation)
- Rotator cuff strengthening
- Scapula stability
- Shoulder proprioception

Common movement dysfunctions and technique faults which should be addressed prior to progressing strength programme as briefly described below:

- *Scapula winging (in various settings)*
- *Elevated scapula/dominant upper traps and levtor scap*
- *Chin poking*
- *Protracted shoulders*

2.2 Movement Quality Based Warm-ups

The goal of these drills is to promote healthy movement patterns during play and training. It is intended that this will result in a reduction in overuse stress associated with dysfunctional patterns and may even enhance technical performance.

There are a number of goals targeted by these movements. The first is to mobilize the thoracic spine and shoulder girdle. This will allow the player to access their full range of movement (ROM) thus supporting performance. It will also reduce the likelihood of compensatory (and excessive) movement at other sites where full ROM is not available elsewhere.

The second element of the strategy is to "activate" the postural muscles of the trunk, rotator cuff and scapula stabilisers. This is intended to counter any habitual poor posture. Numerous examples of these are given on the GBWBA S&C DVD. The design of all of these should allow the player to remain in their game chair and be performed easily and without any external equipment other than a basketball.

Finally, a revision of the commonly used stretches should see a shift from static stretches only to a combination of these and dynamic stretching exercise. Stretches designed to stretch neural tissue will also be part of a typical regime.

Table 2.0, 2.1 & 2.2 - Suitable Warm-Up Activities

Table 2.0 – Static Stretches

Lat Stretch	Chairs diagonal to each other, left hip to left hip. Interlock right hands and roll under arm to stretch lat.
Pec Stretch	Using a wall or partner, abduct arm to approx 80 deg and rotate torso away
Anterior Thoracic 1	Hands clasped behind back, lift slowly (have a partner assist)
Anterior Thoracic 2	Hands clasped behind head, pull elbows back (partner assisted)
Chair Rotation	Left hand on right wheel, pull round to twist torso. Stay upright.
Side Bends	Arm overhead, stretch to the opposite side
Hallelughs!	Same movement as flashers (see DVD). Have a partner assist
Tricep stretch	Elbow flexed and arm pulled behind head with opposite arm
Neck stretches	Various options: chin to chest, lateral flexion

Neural stretch 1	Arm extended and pronated with wrist flexed
Neural stretch 2	Arm extended and supinated with wrist flexed
Internal/External Rot Stretch	Use partner or rope etc to assist

Table 2.1 – Mobility Exercises

BB Back-to-Back Rotations	Chairs back to back, twist to pass to partner. High pointers should go with low pointers who have poor mobility/function
BB Back-to-Back Overheads	As above but arms straight, touching ball on floor then passing ball overhead. Need to go with a player of similar height and arm length
BB Back-to-Back Hi-Lo Rotations	Start gently and slowly increase intensity
Chest Swings	Look to progressively increase ROM
Arm Circles	

Table 2.2- Activation Exercises

Flashers	See DVD
Bruce Lee's	See DVD
Partner Press	See DVD (Can also use a BB against a wall)
No Hands Rolling	3 versions, arms wide (easy) hands together (mod), ball in hand (hard)
Prehab Reverse Pull	Big emphasis on technique (i.e. scap retraction). Players may need to lower their hand position on wheel to avoid upper trap scap elevation
Ball to the sky	Pull arms towards overhead without thoracic ext or chin poke and hold strong isometric contraction
Wheelchair wheel barrow	High pointers only, leg/s on chair, use arms to travel across the court
B'Ball Juggle	Ball help in one hand above head whilst maintaining scap control juggle/spin ball in hand

2.3 Training Load Monitoring

The topic of monitoring training load is discussed in greater detail later in this document (see section 6.4). This can be an important tool in preventing overuse injuries. By monitoring aspects such as pushing volume, training intensity and training monotony it may be possible to identify players who are at a high risk.

Key strategies in this process will include minimizing high volume, low quality training sessions and ensuring that training stress is properly periodized to avoid monotony and provide adequate recovery periods. High volume, low intensity training carries the greatest risk of overuse injury whilst providing the lowest benefit to performance. Despite this many players are still drawn to the long-steady push due to convenience. Players have also fallen victim to monotony of training in the past. This is characterised by little variation in daily/weekly training loads and an absence of progression or recovery on a micro- or meso- cycle basis. This is neither optimal for performance nor healthy for the athlete.

3.0 Strength Training

3.1 Strength Assessment

Strength training is frequently used as a training tool for enhancing WCB performance. Whilst there is a logical rationale for this, to date there is little scientific evidence to support the inclusion of strength work within a programme. Nor is there information linking specific strength qualities or movement patterns with performance attributes.

Furthermore, no normative data exists for strength levels in WCB players. It is therefore difficult to assess whether a player is to be considered weak or strong or whether they have attained sufficient strength levels to support their performance.

In order to address this situation a strength assessment project has been launched in April 2009 involving the GB Snr Mens squad. Below is the initial batch of tests used along with simple protocols and rationale for inclusion. Some initial tentative conclusions have been drawn and these are also discussed below. This should be considered a work in progress as the body of data needs to grow considerably.

Dips – 3RM

The dip exercise is biomechanically similar to the pushing action in a basketball chair. Therefore it is likely that strength in this exercise will result in greater ability to generate force rapidly during the first 2-3 pushes from static.

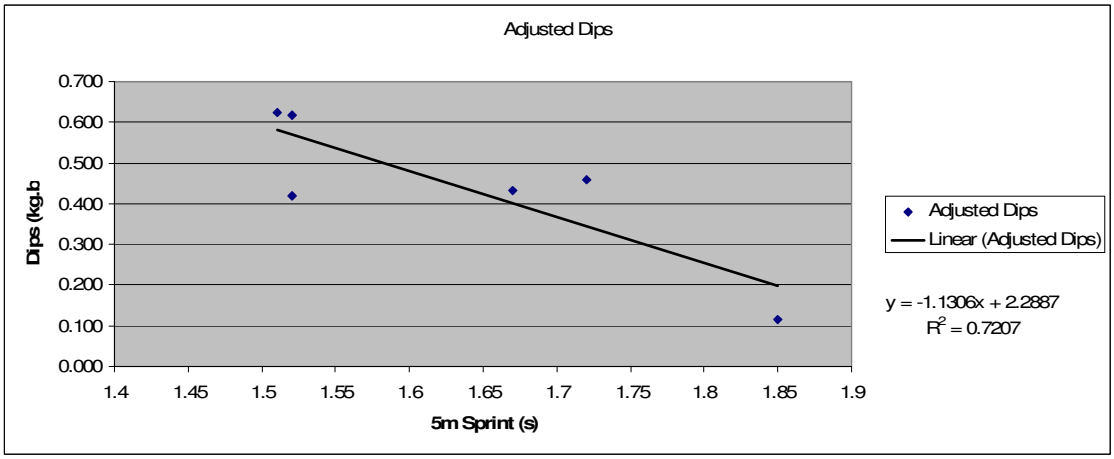
The test is performed using standard dipping bars. Once an appropriate warm-up has been performed the coach should use his judgement to estimate an external load (using a weighted belt) which will be close to the athlete's 3RM. The test is completed once an athlete has attempted a load under which he cannot perform 3 repetitions.

The technique must be performed under control without excessive swinging, chin poking, etc. If the athlete cannot perform the exercise under these restrictions then they are deemed to have reached a technical failure. The full ROM should be utilized, meaning that the upper arm should reach a parallel point at decent and the movement is completed when the arms are locked out. Given that players frequently push from a position of hip and trunk flexion in order to make greater use of the anterior trunk musculature, this is considered acceptable during the test.

If an athlete cannot complete 3 unloaded repetitions then the maximum number of body weight repetitions may be recorded OR the amount of assistance required to achieve 3 reps recorded.

Early results have suggested that strength in this exercise is highly correlated with 5m static sprint times when adjusted for body weight (see figure 3.0 below). This is therefore recommended as a key training tool for improving sprint performance in WCB.

Figure 3.0 – Dip 3RM (adjusted for BW) vs 5m Static Sprint in GB Snr Men.



Bench Press

Wheelchair Basketball is a push dominant sport in terms of both chair propulsion and ball skills. These actions involve a large range of force generation demands. For example, the initial acceleration from static requires relatively high levels of force in comparison to those required when the chair is travelling close to top speed. The force-velocity requirements are shifted even more towards a velocity bias in actions such as passing or shooting the ball. Subsequently a range of bench press tests are used to reflect this.

"Fast" Bench Press 1RM

This test involves performing a standard bench press rep max test but with the added restriction that the bar must move no slower than 1.0 m/s. The S&C coach will use a linear encoder to measure bar speed, testing in sets of 3, and continue to add load until the athlete cannot perform 1 repetition at 1.0m/s or faster. Only 1 repetition from each set of 3 need register a speed of 1.0 m/s or above in order for it to count as successful. After this point the final load achieved within this threshold is recorded along with the speed of bar.

Coaches may use whichever linear encoding system they have available to them provided that consistency of testing is achievable (e.g. BMS, Tendo, Muscle Lab, etc). Please make a note with the results as to which system you used.

Bench Press 1RM

In order to assess the significance of max strength in relation to performance variables a traditional 1RM bench press is included. This should be performed in the usual manner in accordance with standard guidelines.

Early test results have demonstrated large inter-player variability in the relationship between power (as represented by fast bench) and strength (as represented by 1RM) amongst the GB squads. Whilst direct correlations with performance variables are as yet unclear, this does provide insight into where the emphasis of training

should lie for the individual. The data below illustrates the picture of the GB Men's Snr Squad at April 2009.

Table 3.0 – Fast Bench to Bench Press 1RM ratio

N=15	Ratio
Mean	0.57
Min	0.37
Max	0.98
Std Dev	0.15

Whilst allowing for bias within the squad, this current data suggests that ratio of approximately 60% can be considered "normal". Players who score significantly lower than this would appear to have a strength bias and training should be directed towards explosive power. Conversely, those whose fast bench and bench press 1RM scores are very similar are likely to be limited by strength and should place their focus on this area.

Bench Pull 5RM

In a push dominant sport, pulling strength is also clearly of interest in order to ensure that anterior strength does not become overly dominant. The bench pull 5RM test should be performed using a standard bar. Each rep should be performed through a full ROM (i.e. starts from fully extended arm and bar contacts the bench on each rep). Low point players who have limited core function or amputees who lack stability on the bench may benefit from being strapped to the bench or held securely by a spotter.

An optimal ratio between push and pull strength should typically be around 1:1. It is likely that any deviation from this will be in favour of the press. Where there is a significant difference between these qualities the S&C coach should seek to redress the balance.

The figures in Table 3.1 show the ratios of bench pull predicted 1RM (5RM x 1.16) to bench press 1RM in the GB Snr Mens squad in April 2009.

Table 3.1 – Predicted Bench Pull 1RM to Bench Press 1RM ratio

N=15	Ratio
Mean	0.94
Min	0.70
Max	1.16
Std Dev	0.13

3.2 – Strength Training Philosophy

WCB strength programmes in the past have frequently displayed a bias towards "bodybuilding" type methodologies. These programmes typically utilise large external loads rather than body weight exercises, use single-joint movements and target specific muscle groups rather than movement patterns.

Whilst the emergence of S&C professionals working within the sport has started to change these negative trends there is still ground to be made in changing the culture and knowledge base of strength training for WCB. The following guidelines are intended to provide a solid foundation for the composition of a WCB strength training programme whilst allowing coaches to retain the freedom to use their coaching skill and imagination.

1. Prioritize Posture and Function

Also See 2.1 (corrective exercise programmes). These are key goals of an S&C programme. Exercise difficulty/intensity should only be progressed at a rate at which the player can maintain correct alignment and posture. Attention should be paid to maintaining good form at all times.

2. Develop Body Weight Control Before Introducing External Load

Body weight exercises which allow the player to improve "athletic strength" should form the foundation of the programme (e.g. press-ups vs bench press, chins vs lat pulldown). The player should be fully proficient in these before exercises which utilise external load are introduced. These exercises can also be loaded to provide ongoing progressions, eg. Weighted dips, weighted press-ups, etc.

3. Use multi-joint exercises which promote healthy movement patterns.

Whilst there are no "bad exercises", there are a number of popular gym movements which should be avoided unless there is a strong individual rationale. Common examples of these are given in table 3.2.

Table 3.2 – Poor Exercise Choices

Movement	Issue
Pec Flys	Pec dominance in a non-specfic single joint movement
Lat Pulldown (behind neck)	Places the shoulder in a potentially stressful position. Lat pulldown inferior to pull-ups as a gross strength development exercise
Shoulder Press behind neck	Places the shoulder in a potentially stressful position
Upright row	Promotes upper trap and levator scap dominance and places shoulder in unhealthy position (internally rotated and elevated humerus)
Bicep Curls	Only relevant if required for rehab purposes.
Lateral raise	Of no functional benefit
Overhead lifts (excessive use of)	WCB could loosely be defined as an OH sport. Therefore players are at a greater risk of subacromial impingement. This risk is likely to increase through their careers due to bone spurs resulting from overuse.

Exercises which are likely to carry the most benefit with minimal risk include:

- Dips
- Chins
- Press-ups
- Rows
- Unilateral exercise

It should be stressed that these are simply broad guidelines. Some of the "poor choice" exercises may well have individual validity. Conversely the recommended choices above are not automatically suited to all individuals.

4. Include Resisted Pushing

See section 4.

5. Med Ball

There are few upper body resistance exercises which are inherently explosive in nature. Therefore medicine ball work should be included for developing explosive power and teaching healthy shoulder girdle positioning during maximal efforts. This may also help to enhance technical performance of game skills.

6. Core Work

Core strengthening is often a neglected element of a WCB strength programme, particularly in low point players with reduced function. However the core musculature is fundamental in underpinning agility movements in the chair. It also plays an important role in stabilising the player when shooting or passing and extending their reach when competing for a loose ball.

In low point players, developing their core strength, particularly in weak movement patterns, has the potential to greatly enhance performance. Therefore the coach is strongly encouraged to explore the player's ability though all planes of movement and develop as extensively as possible.

7. Train what you can train and move on!

This final point is very important. Too often coaches have felt the need to fill a 1hr session with upper body resistance exercises. Once the relevant strength qualities have been trained in the required movements, the coach should move on to another element of training (e.g core work, chair skills, etc) rather than try to pad the session out with unnecessary extra work.

4.0 Resisted Pushing

Rationale

One of the key performance indicators in WCB is speed of chair propulsion. Consequently speed and power are two of the most important areas for development within an S&C programme. Power for chair propulsion is commonly developed through pressing movements in traditional resistance exercises whilst speed is developed through sprint work within a chair.

True sprint training (i.e. maximal intensity for short duration with long rest periods) has often been neglected in WCB programmes as a greater focus has been placed on conditioning. Furthermore, there are limitations to sprint work within the chair which may not have been acknowledged previously. The nature of true sprint work is that it must be maximal to elicit the desired training adaptations. However, the dynamics of chair propulsion on a basketball court may mean that the athlete does not always achieve this during traditional sprint work. Following the initial two pushes, which generally are maximal, the athlete's ability to impart additional force to the wheel is severely limited due to the fact that the wheel is already revolving at or just below the athlete's maximal hand speed. At this point the level of physiological demand on the athlete (both neural and metabolic) is very low. This type of training should always be included within an S&C programme in order to ensure that the athlete maintains the ability to move his/her hands at maximal speeds. There is though, a clear requirement for an intervention (i.e. resistance) to significantly increase the physical demand on the athlete.

Past & Future

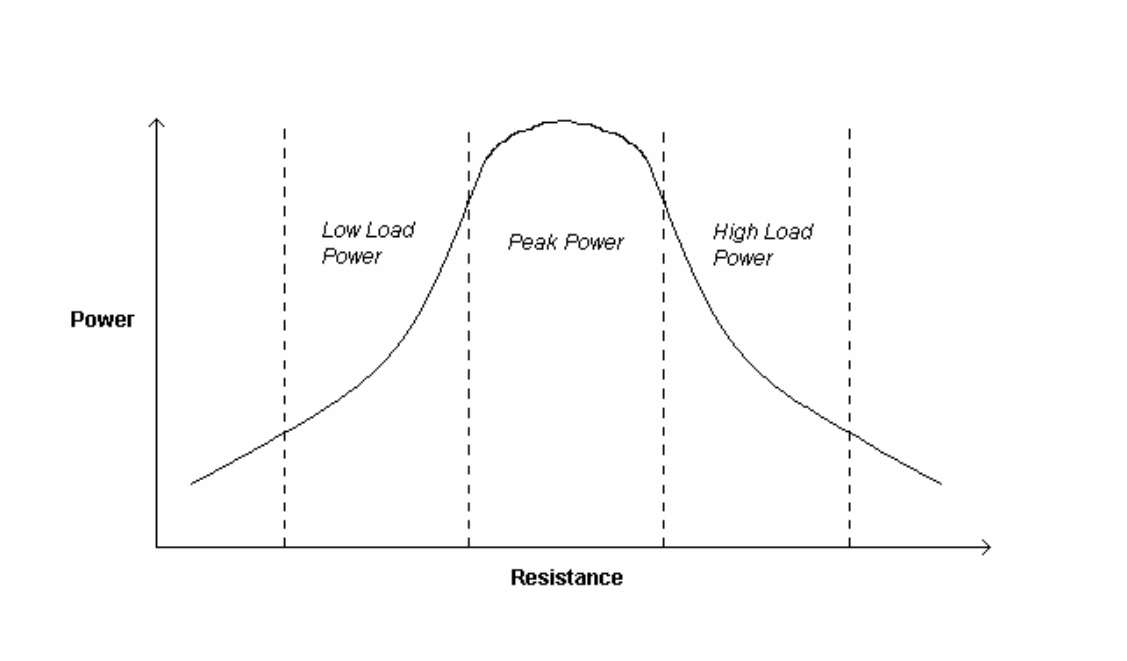
Resisted pushing is not a new concept in wheelchair basketball. A variety of forms of resistance have been used in the past such as partner pulling, sled towing, etc. These have generally been used as a method of increasing the intensity of conditioning work on an ad hoc basis. Whilst resisted pushing has been used to develop sprint qualities its use has been sparring and there is no formal research in the area.

Based on the rationale outlined above, it is proposed that resisted pushing should form a staple part of a player's S&C programme throughout the calendar. As such, players should dedicate either whole sessions, or significant proportions of their sessions, to this type of work. The nature of this work will change throughout the season. For example, some periods may work on strength development through high levels of resistance whereas closer to competition the focus may shift to explosive power with lighter loadings and possibly even overspeed work.

Loadings

The key question with resisted pushing is how much resistance to add. When evaluating loadings of traditional resistance exercises, S&C coaches will often attempt to measure the power output across a range of loadings. This will enable them to develop a power profile and generate a graph which will typically form a parabola (see Fig.4.0 below).

Figure 4.0 – Schematic Power Curve for Resistance Exercise.



The load which enables the athlete to produce the highest power output will vary enormously depending on a number of factors including the type of exercise and the athlete themselves. It is not the case that the athlete should only work within the range which elicits peak power. The athlete should seek a general upward shift in the curve over the course of the season and therefore there are times when both low and high load power must be developed. However it is still important to be able to identify which aspect of the curve is being developed at a given loading.

Due to practical restrictions it is not feasible to test every GB squad member individually to determine personal power curves. Instead it is intended that by testing a smaller number of athletes (across the various classifications) it should be possible to describe a general pattern as to where peak power output is likely to occur. At present this question is being investigated though an applied research project being led by the Snr S&C coach.

Practical Application

There are number of methods of increasing the resistance during pushing, the most popular of which are listed below:

- Partner towing
- Multiple player towing
- Partner pushing
- Sled towing
- Parachute work
- Bungee work
- Incline pushing
- High friction floors
- Combinations of the above

5.0 Speed & Agility Training

Straight-line speed and first 2-push power may be most effectively developed through resisted and assisted pushing (see section 4). With regards to agility, WCB has a distinct set of chair skills and movement patterns which must be recognized when designing a speed and agility programme.

A number of these have been collated on a DVD available from GB Snr S&C Coach. Typical key skills and patterns include:

- U-Turns
- Xmas Trees
- Wall Tilts
- Stop-starts
- Body swerve
- Zig-zags
- ½ turns

For more detail on these please see the WCB S&C DVD. This should provide a valuable resource for S&C coaches who do not have previous experience or depth of knowledge of the sport. The use of these movement patterns will provide a far greater performance advantage than simply transposing running agility drills from team sports such as football.

As with running mechanics in many team sports, fundamental chair skills are often neglected in training sessions where intensity of effort becomes the focus. To counter this problem it is suggested that the warm-up period provides an excellent opportunity to develop these skills whilst the player is fresh and the tempo is sufficiently slow to allow for precision of movement. This may be particularly pertinent for ambulant players or those who have not been using a chair for long.

Speed and agility work should either be conducted early in the session when players are fresh, or as a distinct session in its own right. The work should adhere to standard high quality training principles, i.e (short work bouts, long recovery, etc). When designing agility sessions it may be useful to think in terms of the following categories:

- Stop-start work
- Multi-directional
- Ball & chair skills
- Solo drills
- Competitive drills
- Closed drills (non-decision making)
- Open drills (decision making)

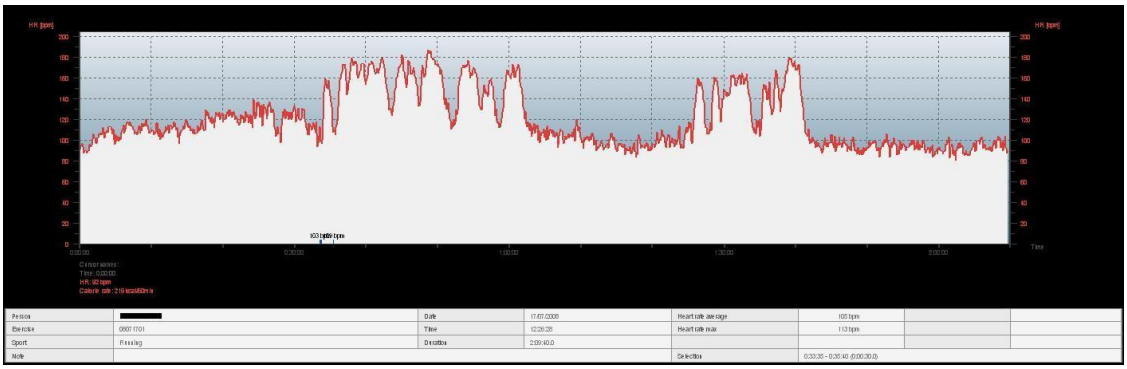
6.0 Conditioning

6.1 Demands of the sport

In terms of the metabolic demands of Wheelchair Basketball, the sport can be loosely defined as a series of repeated sprints. Activity is generally composed of high intensity bouts interspersed with stoppages for fouls etc. The result is a typical work:rest ratio of 1:1. This is demonstrated by the fact that a ¼ which features 10 mins of playing time will generally last approximately 20 mins.

Work bouts typically last between 45-150s (based on GB Snr Men competitive match data). This is illustrated in the heart rate data in Fig. 6.1 below.

Figure 6.1 – HR Data from GB Snr Men's game



Note: The on-court time is represented by the HR peaks whilst the flat, low intensity activity is time spent on the bench.

Heart rate values during play frequently exceed 90% HRmax. Furthermore HRmax data obtained from on-court fitness testing produces HRmax scores which are typical of able-bodied running activity. Therefore it is reasonable to base training upon energy systems which are associated with these high intensities.

6.2 Training Guidelines

Historically, conditioning has been achieved through on-court game based drills and separate fitness activities. On-court game activities are naturally highly specific in terms of movement patterns, intensities and work:rest ratios. However the training load (volume and intensity) has rarely been quantified and therefore the ability to manipulate these variables in a periodized manner is limited.

Separate fitness activities have been highly varied amongst players. These have also suffered from a lack of quantification. Furthermore there may have been excessive use of long, steady, straight line training focussing on the aerobic metabolism. (note: this type of high volume work may have more relevance for new players or those who have not pushed for some time as it allows the skin on the hands to toughen).

The activity profile of the sport dictates that some development of aerobic capacity is required. It has been demonstrated that high intensity interval training (120-140% LT) is a highly effective method of developing aerobic capacity (VO2 peak) (Edge et al 2005). This is clearly preferable to lower intensity work which is less specific to

match play and requires higher volumes of work (and therefore increased injury risk).

Edge et al 2006 also demonstrated that repeated sprint ability is closely related to muscle buffer capacity. Table 6.1 below illustrates the summary of various studies by this group as to the effectiveness of various training protocols.

Table 6.1 – Efficacy of Training Methods on Repeated Sprint Ability

Training Protocol	**Efficacy**
Aerobic work (long, steady)	Poor
2 mins 80% VO2max, 1 min off	Very good response
2 mins 90% VO2max, 1 min off	Not as good
2 mins 100% VO2max, 1 min off	Decreased performance

Based on the current scientific literature and the demands of the sport, Table 6.2 outlines the current guidelines for WCB conditioning

Table 6.2 – GBWCB Conditioning Guidelines (Aerobic Conditioning & Repeated Sprints)

	Min	Max
Interval Length	30s	4 mins
Intensity: VO2max HRmax RPE	 80% 88%	 100% 100%
Rest Ratio	0.5	1.0
Total Work (per session)	10 mins	30 mins

These guidelines are best applied using the following general principles:

- Movement patterns should be multi-directional and include stop-starts (this will also result in higher intensities than steady pushing)
- Activities such as court ladders, stop-start sprints and cross-court races are all suitable.
- Achieving the desired level of intensity is vital and so reversed periodisation is recommended (i.e. begin with short intervals and extend duration).
- **Adhering to the guidelines on rest intervals is crucial**. Previously very short rest intervals have been used (<10s). This has the physiological effect of reducing intensity and failing hit the target energy systems.

6.3 Fitness Testing

GBWBA Coaching staff use a variety of on-court tests to evaluate players. These include an intermittent shuttle test (Bleep test), a Figure 8 agility test and a basketball throw.

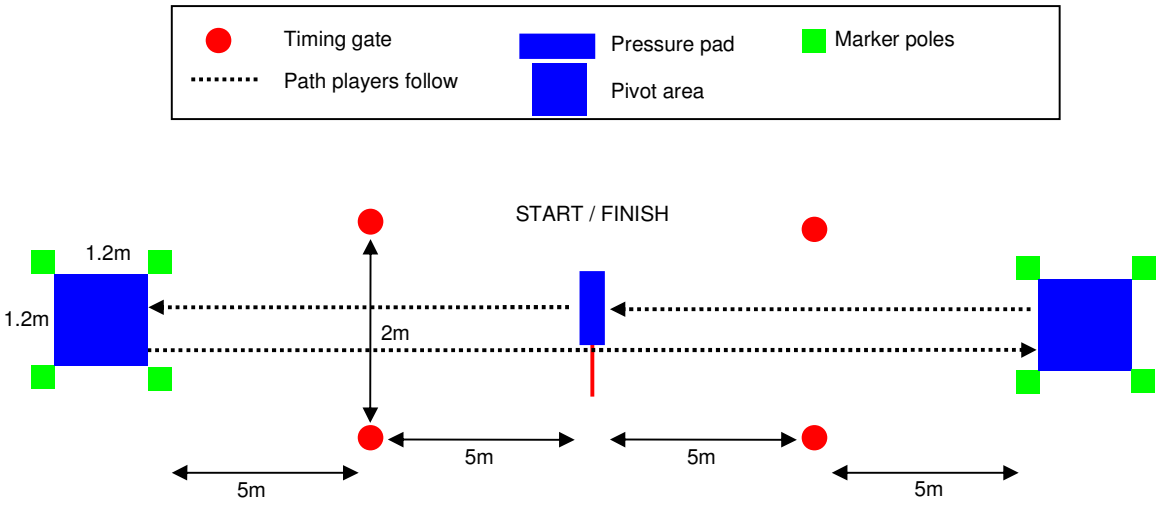
EIS S&C staff and GBWBA staff (Grantham,Titmus & Brice) have developed a repeated sprints test which provides insight into a number of variables including:

- Static 5m sprint time
- Rolling 5&10m sprint time
- Left turn vs. right turn
- Repeated sprint ability/fatigue index

This test can be carried on a standard basketball court using timing gates and cones. The test involves 10 repetitions of 10m – 20m –10m shuttles with two 180° pivots. The direction of pivot is alternated on each run. The first repetition is started so that the player has to make a left hand pivot. The second repetition is started so that the player has to make a right hand pivot. This alteration of turning direction continues for all 10 efforts.

For each repetition players sprint 10m (between the timing gates), pivot within the turning area and sprint 20m (between the timing gates), pivot within the area and sprint 10m (between the timing gates). The player has 30 seconds from the start of one repetition to the start of the next to complete the course, and recover, before the next repetition begins. A total of 10 repetitions are completed. Each run should be a maximum effort. This is illustrated in Figure 6.1 below.

Figure 6.1 – Repeated Sprint Test Schematic



Data from this test has been collected from 2007 to date in order to develop bench mark data to allow evaluation of the training requirements of a player. The most recent group norms are described below (GB Snr Men)

Table 6.3 – GB Snr Men Repeated Sprints Normative Data (Jan 2007-Feb 2009)

Fitness Component		1.0			1.5			2.0			2.5			3.0			3.5			4.0			4.5		
		Average	Slowest	Fastest	Average	Slowest	Fastest	Average	Slowest	Fastest	Average	Slowest	Fastest	Average	Slowest	Fastest	Average	Slowest	Fastest	Average	Slowest	Fastest	Average	Slowest	Fastest
Speed	5m (Static)	1.83	1.97	0.09	1.83	1.94	1.75	1.66	1.86	1.40	1.61	1.81	1.37	1.65	1.82	1.50	1.55	1.67	1.49	1.62	1.73	1.50	1.59	1.74	1.43
	5m (Flying)	1.55	1.65	0.04	1.47	1.51	1.39	1.41	1.63	1.27	1.42	1.58	1.28	1.45	1.62	1.29	1.34	1.40	1.24	1.44	1.55	1.12	1.39	1.58	1.26
	10m (Flying)	2.58	2.77	0.12	2.53	2.55	2.51	2.37	2.67	2.17	2.37	2.65	2.03	2.47	2.76	2.26	2.26	2.40	2.18	2.46	2.69	2.32	2.33	2.58	2.12
Agility	Left Turns	4.87	5.29	0.27	4.62	4.76	4.47	4.48	5.04	3.85	4.40	4.80	3.74	4.51	4.86	4.03	4.18	4.78	3.99	4.39	4.85	3.91	4.22	4.84	3.79
	Right Turns	4.80	5.03	0.18	4.66	4.80	4.46	4.45	4.94	4.05	4.42	4.73	4.00	4.46	4.80	4.20	4.47	4.47	3.51	4.41	4.90	4.15	4.30	4.84	3.91
Speed Endurance	Fastest	15.52	16.25	0.40	15.11	15.43	14.64	14.36	15.93	13.45	14.22	15.77	12.99	14.55	15.60	13.76	13.37	14.38	13.07	14.35	15.79	13.48	13.92	15.22	12.78
	Slowest	17.25	18.28	0.79	16.33	17.43	15.71	15.39	16.95	14.08	15.25	16.41	13.79	15.46	17.00	14.58	14.66	16.68	13.72	15.49	18.13	14.18	15.12	17.28	14.08
	Total	165.86	174.65	6.56	158.23	165.94	151.97	149.64	164.87	137.34	148.09	160.44	134.65	151.05	162.86	142.98	141.40	158.48	135.10	149.99	166.52	139.96	145.89	163.40	136.19
	% Drop	11.17	15.99	3.77	8.05	13.11	5.08	7.24	15.61	2.95	7.33	10.62	3.74	6.28	13.71	2.51	9.47	15.99	4.02	7.89	14.82	3.86	8.64	15.26	4.29
Number of entries		18			4			24			18			17			5			16			25		

6.4 Quantification & Monitoring of Training Loads

It has been identified that a current weakness within the GBWBA system is that training is not effectively quantified. This leads to wide disparity in training loads between players, an inability to accurately evaluate a players' training load and a lack of load manipulation (periodisation).

Various solutions are currently being considered. At present GBWBA are trialling the TRIMP system (TRaining IMPulse). This will be used in conjunction with an RPE (Rating of Perceived Exertion) score to allow remote monitoring. Further information will be published at a later date. However a brief description of the system is given below.

1. Training Intensity is measured using the RPE scale in Table 6.4. Note, a session may include more than one score if varied activities were used, e.g. shooting 20 mins at RPE 3, scrimmage 20 mins at RPE 6, etc.

Table 6.4 – Borg CR10 RPE Scale

0	Nothing at all
0.5	Extremely weak, barely noticeable
1	Very Weak
2	Weak (light)
3	Moderate
4	Somewhat strong
5	Strong (heavy)
6	
7	Very Strong
8	
9	
10	Extremely strong (maximal)

2. TRIMP Score is calculated using Intensity x mins trained

e.g. RPE 6 for 5 x 3 mins intervals
= 6 x (5x3)
= 6 x 15
= TRIMP score 90

Weekly TRIMP = Total of all sessions

Monotony = Weekly TRIMP/std dev

Strain = TRIMP x Monotony

References

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