Speed from Strength

By Steve Bennett
B.Sc. (Physiology)
www.oztrack.com

A great thing for any runner to develop would be more “bounciness” and in any endurance athlete would be “sustained bounciness”. The good news is most athletes can improve the power and also the sustainable power of their stride by a large amount.

Sprinters can improve their stride frequency by improving technically in a number of ways. They also need to have optimized their power delivery by having high levels of stabilization strength and developed powerful prime movers. For many people running fast can be developed very simply. They just need to develop strength in the gym and practise fast running that creates the opportunity for the nervous system to better learn how to utilize the gains in strength.

Middle Distance athletes have a need to develop high levels of endurance so they can sustain race pace for the distance required e.g. 55s laps for 1500m. To win these athletes will also need to be able to change pace rapidly and have a sustained higher speed finishing burst.

In Australia we have just had Said Aouita appointed as our National Distance Coach. I am fortunate to be able to spend quality time with him discussing training methods and his philosophy. The key area of his philosophy is for athletes to do enough quality volume in key sessions to develop high levels of stamina. He also believes in building very good recovery into a program by having plenty of recovery days and weeks.

Said believes in the following ideas:

- Speed for Middle Distance athletes can be developed from the effects of weights, many repeats of short hill repetitions and plyometrics. Importantly this can be done without the athlete doing volumes of really fast sprinting, which for middle distance athletes is a common cause of injury.
- Plyometrics is even more important than weight training in developing the type of speed that Middle Distance athletes need.
- The key to developing athletes who can be safe training with plyometrics is to have young athletes doing a variety of lower intensity plyometric activities. As adults these athletes will be much more able to fully implement training in this area to great effect with safety. Older athletes need to build intensity slowly in this area.

In the past my squad has performed a large amount of variety of plyometrics. The activities described below have been enjoyed by the squad and have not caused any injuries, even with young athletes.

A summary of some of the activities from our plyometric program follows:

Hill Bounding
Hill bounding is very effective at improving hip extension power and can have a great impact on all runners regardless of their event. Hill bounding stimulates the athletes to be able to generate more power which is sustainable and is also good conditioning for other more intense power activities.

All bounding involves the athletes impacting with a flat foot and having an active foot strike (the foot is moving backward as it hits). Athletes need to stay tall, lift their knees high and in long bounding aim for some “hang time”. Each foot contact needs to add to momentum, it is common

to see athletes reaching in front for more distance which causes them to lose more momentum. The key is to have the athlete use high levels of hip extension power generated by the glutes to project the body forward. When bounding up hill it is best to make sure the athletes foot on impact is pointing straight up the hill and the knees should be lifted up high in front while the athlete stays very tall.

The sprinters in my group in the early phases of periodization have done 2 sets of 5 x 60m hills where they run 20m – bound 20m – run 20m. They have often progressed to 2 x 5 x 60m hills where they bound 20m – run 20m – bound 20m. They do these with 2min between reps and 5-10min between sets.

The Middle Distance athletes have built up to do more of them and we have found good effects from 20 x 60m hills with 20m bound – 20m run – 20m bound with a walk down rest. They do the bounding less powerfully than the sprinters and do more of them quite safely. The activity is low stress on the athletes structurally but they can certainly feel it the next day by having sore glutes, this is evidence of some good work being done.

With the MD athletes we also sometimes do hill circuits where the athletes bound up a 50m hill run across the top and then swiftly down a gentle slope across to the bottom and then back up the 50m bounding section. The circuit has been about 600m a lap and they have built up to doing 6 laps.

Bounding
We perform three types of bounding. All three kinds we have had great success with while using very low volumes.

Standing start bounding performed about once per week for much of the year.
5 repeats of 4 bounds and a jump into a sandpit. Measure the total distance of each effort and strive for progress. Improvements in mid-torso strength and leg strengthening from weights (especially the glutes) should assist progress. Rest between at least 3 min. I have athletes do these in racing flats on a mondo surface. Most athletes can improve the total distance by over a metre in a season.

Running start bounding
Running start bounding is performed more with sprinters/jumpers. It requires the athlete to be technically good at standing start bounding. The athletes need to get off the ground much quicker after each contact during this type of bounding and because of this it is much more specific to sprinting. The athletes in my squad have often performed 5 repeats of 4 bounds and a jump into a sandpit from a 10m running start. Once again the total distance is measured and the athletes aim to progress. Athletes may need to start with a 5m running start. High level athletes can progress to doing them with a 8 stride run-up and then 9 bounds and a jump into the pit. Middle Distance athletes do running start bounding in the pre-competition phase as well.

Speed Bounding
This is the most specific form of bounding a sprinter can perform. We usually do speed bounding from a running start over 20m or 30m. We time the athlete over the distance and also count the number of steps. By multiplying the time in seconds by the number of strides the “Speed Bound Index” can be calculated. The lower the index the better the athlete. Once again we only do about 5 attempts over 20-30m and have seen great athlete progress.

There are many more intense activities that will be covered in a future article, but the ones listed above are simple and effective when used by any running athlete.

Energy Systems & Efficiency

By Steve Bennett
B.Sc. (Physiology)
www.oztrack.com

There was recently a great article in the 3 / 4 2002 edition of IAAF New Studies in Athletics. titled "How does V02 evolve during the 800m?" by Hanon, Thomas, Chevalier, Gajer and Vandawalle. The researchers studied many physiological parameters during 800m race conditions. The athletes used were about 2:00min athletes. The findings make interesting reading as some of the data is surprising. The summary follows:
Phase 1- VO2 increased during about the first 315m which was 45s.
Phase 2 - The next 215m up until about 535m VO2max was maintained. This was a total duration of just 33s and 320m. The furthest anyone in the study maintained V02max was to 640m.
Phase 3- V02 gradually decreased to reach an average of 83% of VO2max at the finish line. The average decrease was 20% with a range of 13-27%

The explanation for the dramatic change in Phase 3 was suggested to be hyperventilation, lowered blood pH, fatigue of respiratory muscles and a decrease in heart stroke volume. All of these factors contributing to a reduction of gas exchange with the blood.

It is apparent that only 33s of 120s in the athletes tested was spent at V02max which is 27%. However the decline phase lasted an average of 43s which is 36% of the race.

The 800m race is run at an average pace which is well above the Maximal Aerobic Speed (MAS). In this study the average pace was 124% of Maximal Aerobic Speed. Even when during the final phase and in the last 25m the athletes speed was still an average of 112% of MAS. This emphasizes that the speed capacity is being provided to a great extent by the anaerobic system. At this point the aerobic energy system would have dropped its total energy contribution significantly since the athletes VO2max was recorded at around 80% of maximum.

In my view it is certainly worth working the V02max and improving it. But it seems that an athlete could improve their VO2max and maybe not be able to sustain it for very long. It seems more desirable to be able to sustain it for longer or prolong the distance decline starts to occur. It is also apparent that athletes also need to fully develop their anaerobic systems since the speed of the race is always going to be well above MAS even when in the final 25m. It is no point having a highly developed aerobic system and an under-developed anaerobic system.

Running at any given speed during an 800m race will require the energy to maintain that speed to come from all of the bodies energy systems. In the middle of a race the athlete is not accelerating and all they have to do is maintain momentum, fundamentally all this requires is a certain magnitude of force being delivered to the ground.

One extremely important aspect to have a long term view about is in developing the athletes efficiency at race pace. This is because with improved efficiency there will be a lower energy cost to run at race pace. This way whatever the athletes energy systems will be able to provide in total, will be able to result in a faster performance. A useful analogy from motor racing is that it makes no sense supercharging a race car at great expense to improve its engines power and ignore improving its weight, aerodynamics, tyre pressure, gearbox etc.

The added problem with running is that training that may develop energy system outputs may also have the undesirable effect of decreasing running efficiency. This can come about as the result of the natural shaping effect on efficiency that occurs from the athletes practising the running habit in a way that exhibits bad running form. Bad running form can easily occur in any

athlete who has not worked directly on improving its maintenance. Most athletes when fatigued can easily lower their centre of gravity by having a more bent support leg, lowered hips, low knee lift, overstriding in attempts to maintain stride length, excessive rotation of torso, footstrike not straight, etc.
The same session in one athlete may shape improved efficiency where in another under-prepared athlete may impact to decrease efficiency e.g. Wilson Kipketer doing 20 x 200m in 26s regardless of the rest in between would tend to hold great form and make that pace look really easy. He would get slower if super tired because of loss of prime mover power but it would not be accompanied by over-striding, wobbling, significantly lowered centre of gravity etc. However a common under-conditioned athlete may do a similarly intense session and look like many recreational roadrunners do after 5 reps and then practise progressive loss of form for the next 15. The athletes would display worsening form in areas such as overstriding, trunk rotation, bent leg in support phase, low knee lift - obvious long contacts , straining etc. This athlete may finish the session proud and satisfied because they know that this speed session will make them “fitter” i.e. it will improve their energy system outputs. The sad hidden truth is that performance in races may decrease due to the negative impact that sessions performed in this way may have on their efficiency. People may argue that if the athlete improves in each session then the session must therefore be worthwhile. The flaw in this thinking is that the energy system adaptations that are happening may be of a short term nature. The potential improvement in efficiency is much more longer term. As is the damage to efficiency much more longer term. This is not the sort of thing that an athlete can detect "this season". However it is a fault that will have a great impact long term on athletes who train under coaching regimes that ignore the concept.

No technical training will improve an athletes efficiency "today", try running on a treadmill at a certain speed and change your technique, you will not be able to impact on heart rate at all. This is because the effect of improving running form on efficiency is a very much slower adaptation than we are used to noticing. I think coaches & athletes enjoy the quickness of so many of the adaptations that we can bring about with training, that we ignore some of the important slower ones. EFFICIENCY should targeted and underpin our training philosophies because it is this important area we compromize when we forget about it. The problem is athletes often try to run with a better technique and feel that it is not working and this is because it isn't going to show gains this month or even this season that will impact on performance. It is just like the first time someone shows you how to swing a golf club. It initially starts off feeling really "fake" and it is. But eventually it becomes the habit and feels totally normal, this happens after plenty of shaping of the skill. When it feels totally normal after a long process of tuning what started off as an ineffective way to swing becomes much more effective than the “natural swing” the person could have been stuck with. The only way to find out the truth about the value of being taught this skill was to trust the coach and have patience.

Training short term (season by season) in the area of energy systems can be a long term disaster for the athlete. This is especially true if young athletes do not have programs that target predominantly the development of efficiency first so that good habits are in place. They could then later introduce higher levels of energy system focused training as they improve their tolerance to maintaining really good form under increasingly higher levels of fatigue. With young athletes there is no time to waste in developing this ability because before very long there will be great pressures to train energy systems to cause higher levels of performance to be available in the short term.

The Identification & Training of sub 2:10 800m Women

By Steve Bennett
B.Sc. (Physiology)
www.oztrack.com

800m runners need a balance of speed, strength & endurance. This makes it possible to identify a range of athletes that have sub 2:10 potential for the event. What some athletes lack in speed they can make up for it with superior strength & endurance. The minimum 1500m ability that a sub 2:10 athlete needs is probably 4:48 but they would need to have sub 55.0s 400m ability. What some athletes lack in endurance they could make up for with superior speed & strength. The minimum 400m ability an athlete would need to run sub 2:10 is probably 61.0s but they would need to make up for this with sub 4:20 1500m ability, this would usually only be evident in 1500/5000m specialists.

A typical sub 2:10 women whose best event is the 800m would usually have both 400m ability of sub 58.5 and 1500m ability of sub 4:36. This means in talent identification we are looking for athletes who can be developed to run 100m & 200m in sub 13.50s and sub 27.00s respectively. Certainly the more sprinting speed the better and this can be considerably improved over a career by smart use of weight training and plyometrics. The athletes also need to be able to steadily improve their 1500m ability. Potential in this area may be displayed by them being reasonably talented at cross country with many having run sub 12:00 min for 3000m as 11-13yr olds. Ideally what we are looking for are strong, nice moving athletes who show talent at both cross country and at sprinting.

Training for 800m involves a very enjoyable mixture of a great variety of activities. All female athletes benefit greatly from weight training and other more specific conditioning exercises. 800m athletes can vary the emphasis from lighter conditioning work that can target mid-torso stability all the way through to maximum strength training. Usually athletes do 2 sessions a week of weights for most of the year and sometimes up to 3.

800m athletes also need to develop high levels of “ease of speed” and a great way to do this is with a safe implementation of plyometrics notably alternate leg bounding. The athletes in my squad perform activities such as 4 bounds and a jump into a sandpit from a standing start, or similar from a 10m running start, speed bounding from a 10m running start over 20m, bounding up hill on grass (up to 800m in a session), relaxed bounding over 60m (up to 300m in a session) and low (<40cm) quick double-legged hurdle bounces. We also combine bounding with relaxed practice at near 800m goal pace over 150m reps often in sessions such as 4 sets of 4 x 150m with enough rest to run nicely at near 24.0s to run 2:10.

Endurance for 800m athletes should be developed by building a great base in the first 3-4 months of the year. This can come about by performing sessions such as:

- 10-15 x 400m reps with 1min rests sub 76s
- 6000-8000m of long reps on grass e.g. 3-4 x 2000 rest 3min sub 7:20 , 4-5 x 1500 rest 3min, 6 x 1000m rest 3min or 2000, 1500, 1500 , 1000, 1000 with 3min rest
- Hill repeats up to 3000m of reps with short rests. Usually using shorter hills.
- Recovery runs 20-30min, moderate runs 30-40min and longer runs 40-75min

Hills are very valuable to 800m athletes as there is a great need for strength endurance. A favorite session used by my squad is 3 sets of 5 x 80m grass hills with 60s rests between each. The athletes bound 20m then run 40m then bound 20m. They have 3 min recovery between sets then do about 16 reps of each of 4 basic exercises e.g. crunches, pushups, supermans & bridges. After the session is finished they often do 3 x 150m on the track with rests of 3-5min at close to 400m race pace staying as relaxed as possible.

Later in the year the athlete needs to develop the ability to relax at race pace and then merge their endurance capabilities into speed-endurance with sustained higher intensity longer reps. Longer hard reps are the most specific and effective training an 800m athlete can ever do. The key is to be able to do them with high quality even if this requires rests exceeding 10min. However the athlete is in awesome shape when they can perform an appropriate amount of work at high intensity using shorter rests of 3-8min. For 800m specific work the sessions should have a total volume in the range of 1600-2400m. Some sessions ideas are:

- 4 x 800m rest 5min sub 2:30
- 4 x 600m rest 5min sub 1:44
- 5 x 300m rest 5min sub 46s
- 8 x 200m rest 3min sub 30s
- 3 x 500m rest 8min sub 81s
- 6 x 400m rest 2min sub 69s
- 4 x 400m rest 6min sub 62s
- 300 - rest 45s - 300 rest 8min 300- rest 45s - 300 average sub 49s
- 800 – 400 – 800 – 400 rest 12min between
- 600 – 400 – 200 – 200 rest 12min between each

Pure speed development for 800m athletes can quite safely involve the use of 30m sprints from a standing start. To run sub 13.50 for 100m athletes would need to be able to run 30m timed from their first leg movement in 4.42s, the more typical 100m speed requirement of 12.90 would need 4.22s. Speed development is best to start with just 2-4 efforts over 30m at maximum speed and work from longer distances such as 150m run in 21s and progress in the pre-competition phase by slowly doing them faster and over shorter distances – finally progressing to activities such as performing a few flying start 100m reps in the mid 12s range. It is not worth the risk to do maximum effort 100m efforts from a standing start as the speeds reached are much higher than an athlete would ever need to run even in a 400m race. Sprinting at maximum effort for distances of 60-100m produces great stress to the athlete in maintaining good sprinting form and any loss of form can easily result in injuries to hamstrings etc. This is especially true in athletes that are doing a high % of slower work.

It is important that athletes make a consistent effort to optimize their recovery between sessions. It is very easy for soreness to carry over from one session to another and invite injury. The use of hot & cold treatment is very effective e.g. 3 min in a hot shower and then 10s in a cold bath repeated 3 times. Also of great importance is sleep as this is when most improvement through adaptation occurs, aim for 9 hours a night & plan to wake up at the same time each day.

I have had a number of girls develop to sub 2:10 all have had sub 13.00s 100m ability and been capable of at least 4:37 at 1500m. The use of weight training, plyometrics and plenty of relaxed race tempo practice were major contributors to their performances. They also do a great variety of activities to target improvements in core stability including pilates, swiss ball, boxing and medicine ball throws.

A common problem with female athletes is low iron stores. Make sure nutrition is good and that iron stores (Ferritin) are kept safely above the normal range required. Many female athletes spend years with low iron stores and never see their true endurance potential.

Preparing for 800m is very enjoyable and I would invite any women to take up the challenge of preparing for an event which requires you to work with such a great variety of training modes. The shifting balance of activities throughout the year means that almost every month can be quite different. Athletes can take great pride in their steadily improving speed, strength and endurance from year to year.

Training For 400m

By Steve Bennett
B.Sc. (Physiology)
www.oztrack.com

The one thing successful 400m athletes have in common is that they have to be aggressive and tough. But there are great extremes of variety in the way that 400m athletes can be prepared. Athletes can be 200/400m types such as Cathy Freeman or Michael Johnson or 400/800m types like Jearl Miles-Clark or Alberto Juantorena. Some also may be pure 400m specialists with balanced ability over 200m & 800m like maybe Anna Guevara or Felix Sanchez.

Athletes when racing the 400m event need to be able to run at a high percentage of their maximum speed for a prolonged period. A pace analysis of the World Championships in 1999 showed that Michael Johnson's maximum average speed over 50m was 10.09 m/s where the maximum speed reached by Maurice Greene in the 200m was 11.09 m/s & in 100m was 11.90 m/s. This means that Michael Johnson needed to use over 85% of his maximum speed during a 400m race and he was still running at an average of 9.54 m/s between 200m & 300m. This is still over 80% of his maximum velocity. Improving maximum speed in any athlete can improve their ability to maintain speed in a 400m because they will have more speed in reserve. However maximum speed training comes with a greater risk of injury than slower endurance work. Maximum speed training is also much more taxing on the nervous system producing flatness that can effect the quality of sessions that follow in at least the next 48hrs.

There is however, much more to improving the ease of an athletes speed than expanding maximum speed. Many 400m athletes tend to have longer strides coming from more power. This means they tend to get more of their speed from stride length rather than high stride rates. This makes sense scientifically as high stride frequencies will be more taxing on the nervous system and may require more energy especially from the upper body which will be more difficult to relax at higher rates. Stride length can be improved in a variety of ways by the smart use of weight training, plyometrics & hills.

Some may argue that Michael Johnson is a big exception to the theory of 400m athletes focusing on stride length. Michael Johnson tended to maintain very high stride frequencies throughout the entire 400m event. He did this by having exceptionally short contact times with the track and probably by doing so was able to lose less energy on each impact than the other athletes. Michael Johnson also had a surprizingly long stride which came from extremely high levels of power.

Minimizing wasted energy due to over-striding is worth working on with any athlete. Over-striding occurs when athletes contact the ground too far forward. Over-striding results in a jolt through the body that can cause injury and results in an excessive loss of momentum during the first instant of ground contact. One simple way to decrease over-striding is to find a slight downhill slope and have the athlete run down it aiming to run smoothly by minimizing the feeling of impacts that occur. This can be achieved by intentionally aiming to contact the ground further under the body. The effect of over-striding will be magnified for the athlete & they will easily be able to learn how to adjust the position of contact in a way that has the desired effect. They should do maybe 2 sets of 3 x 50m hills with 2 runs on the flat after each set. Doing this simple session regularly should produce a noticeable decrease in the extent of over-striding. The most common time for an athlete to over-stride is at the end of a 400m race so it is worth doing some work on the track when fatigued to optimize the athlete's ability to finish most effectively.

Developing high levels of endurance is very important for the 400m event but it is essential that it be based on developing endurance of race speed. The ability to be able to run the first 200m fast & be able to not blow up in the closing stages is very much related to the amount of speed the

athlete has in reserve in the first 200m and then the speed endurance to maintain a high percentage of that pace. Endurance that is developed at slower paces uses different running biomechanics & is limited in its transfer to the 400m race. General conditioning is of great value but is essential to perform appropriate specific work at the right pace & also simulating conditions of race like fatigue. 800m athletes have highly developed speed endurance at their race pace but if you put them in a 400m without specific race pace work & without having them race some 200m events. Then their performance at 400m will likely be below what is expected. They also will have a weakness in being able to compete against 200m types in an aggressive race. The faster 200m type athletes will often blast the first half of the race & blow up in the final straight. 800m type athletes would be expected to finish strongly but since they are slower in maximum speed capacity they are more fatigued by the fast early pace & often waste their finishing advantage in trying to stay with the faster 200m type athletes early in race. This fact suggests that the best type of athlete to be is the 200m type athlete as it presents them with more options in terms of pacing the race.

An important exception to the event favoring 200m type athlete is when the athletes need to race in major championships and endure up to 4 rounds of competition. This situation rewards the athlete with the best ability to back up. Less well conditioned athletes will struggle both in terms of physiological performance deterioration & with having legs that are sore. The best way to avoid these problems is by making sure the athletes have built a bigger base with higher volumes of training. There are many athletes from a 200m background who can run a brilliant single 400m race with minimal training. But if you try to get them to race multiple races in a major championship they are often so sore the day after a fast race that there is no way they can excel in major championships.

There are many varieties of speed endurance training. It is important to train with a balance of the different varieties. It is not near as simple as just running at race pace with short rests until highly fatigued & expecting optimal gains in performance. My preferred method is to improve biomechanics and ease of race speed first. This is done with tempo runs at race pace performed with low levels of accumulated fatigue as well as maximum effort acceleration work over 30-40m. The athletes can then expand how far they can sustain 400m race speed by performing longer repetitions with longer rests. This works at boosting the amount of energy supplied by the Lactic Anaerobic system. Then the athlete can work at maintaining running speed when experiencing high levels of acidosis. This is best done in low key races & with smart use of lactic tolerance work at training. Lactic tolerance training is typically fast short repetitions with short rests. It is often over used with athletes & can produce rapid gains initially but it should be regarded as the icing on the cake.

The next article will include discussion of a variety of sessions performed by some well known 400m athletes.

Training Ideas For 400m

By Steve Bennett
B.Sc. (Physiology)
www.oztrack.com

There are many ways to prepare for the 400m event. This article will outline some of the methods used by some Australian Athletes.

Australian Moscow Olympic Silver Medallist Rick Mitchell (44.84s) prepared in a way that was designed to prepare him to cope better with multiple races in major championships. His training was aimed at one peak a year. Early in the year his training included a lap of Melbourne's "Tan" which is a 2.5mile lap before the main part of his training session. He sometime did 2-3 laps. Rick trained 6 days a week. Some main sessions performed in the first phase of the year were:

- 10 x 400 with short recoveries (building over the months to 57-58s with a 100m walk recovery)
- 2 x 400 2x 300 2 x 200 2 x 300 2 x 400 with short recoveries
- 8 -10 short hills (Hills were performed for the first 6 months of the training year)
- 6 x 400m hills
- 6 x 200m hills
- Time Trials over 2min

Sessions mid year included:

- 3 x (100 - 150 – 180) with walk recoveries and performed at 95% with 400m walk between sets.
- Time Trial 2 x 500m with first 400m in 49s rest 20min
- Time Trial 2 x 300m rest 20min or 3 x 200m rest 20min
- Time Trial 600m
- Fartlek - 2.5mile easy 2.5 mile hard 2.5 mile easy
- Continued with many of the same track sessions as earlier in the year.

Early Competition period included:

- Racing almost every weekend. Rick often raced 15 100m races, 20 200m races, 15-20 400m races & 2-3 800m races in a season. At every meet he would compete in multiple events & relays, he considered this to be his speedwork. Very little training was performed ever at a speed above what would be evident in a 400m race.
- 100-110-120-130-140-150-160-170-180-190-200 with walk recoveries.
- Starting at 350m to go. 60-90-120-150-180-210-240-270 with a walk back to the starting position. This session is great for experiencing the feel of the main part of a 400m race.
- 6-8 x (200-100) with a short rest between reps and a longer rest between sets.
- Some flying start 100m runs.
- Small amount of block starts and rarely maximum speed sprinting during training.

Major Competition preparation period

- Involved performing training simulating the race structure of the 4 rounds of competition.

Sydney Olympic Champion Cathy Freeman's Training is more sprint based than Rick Mitchell's but there is still a great amount of time spent building a base. Cathy's preparation for the Sydney Olympics started 18 months out from the Games in April 1999. She had 2 short periods of Racing 13 & 8 months out from the Olympics.

During a 3 month General Preparation period some of her training consisted of:

- Hypertrophy weight training sessions 3 times a week.

- 2 hill sessions a week.
  - 6 x 140m moderate incline hill on grass with a 4min rest.
  - 4 x 180m steeper hill on bitumen rest 8min then some shorter hills.
- Aerobic training such as
  - 5 x 3 x 200m rest 30s/ 5min between sets or 2 x 4 x 300m rest 100w between reps
- Longer faster reps such as
  - 6 x 400m rest 6min or 500m 3min 2 x 300m 100w 3min 4 x 200m 1min
- Faster shorter reps such as
  - 2 x 4 x 150m rest 3min / 7min between sets 8 x 200m rest 2min
- Pool recovery session

Minor Competition preparation 8 months before Olympics consisted of:

- 2-3 weight training sessions a week – more strength based.
- 1 hill session most weeks of something like 6 x 140m moderate incline hill on grass with a 4min rest.
- Some faster speed development work e.g. 6 x 100m in & outs, 2 x 150m fast relaxed
- Some starts, resisted & assisted work once a week for a month.
- Lactic tolerance e.g.
  6 x 200m with diminishing rests 5-4-3-2-1min or
  300m 1min 150m 10min 200m 1min 120m 8min 200m 1min 120m or
  500m 2min 120m 10min 400m 2min 120m 8min 300m 2min 120m 6min 200m 2min 200m
- Race 3 weeks in 4 in the main month.

Specific Preparation 5-7 months before Olympics consisted of:

- 3 strength based weight training sessions a week
- 2 Hills sessions (same as in General Prep)
- 1 session a week of Plyometrics & Speed
- 1 session a week of faster e.g. 3 x 3 x 120m rest 3min/6min
- Speed Development e.g. 4 x 30m, 2 x flying 30m, 6 x 120 in & outs with full recoveries.
- Longer reps e.g. 500m 8min 400m 6min 300m 4min 200m
- Lactic Tolerance e.g. 3 x (300m 1min 150m) 10min between sets
- Swiss Ball & Pool session once a week

The weekly structure was usually
Sunday- Steeper Hills
Mon - Plyo & Speed then weights
Tue – Faster shorter reps
Wed – Hills then weights
Thu – Speed Development
Fri – Pool session & Swiss Ball
Sat – Long reps or Lactic Tolerance

It is interesting to note above that her speed development & faster speed endurance sessions were conducted the day after a hill session. Hill sessions involve longer ground contacts, lower stride frequencies & therefore less nervous system stress. This should result in hill sessions not producing flatness the next day when conducted in volumes that the athlete performs regularly.

The Early Competition Phase leading into the Olympics tended to follow a pattern something like:
Day 1 Speed Development & weights
Day 2 Fast Lactic Tolerance short reps
Day 3 Faster Tempo or Time Trial e.g. 350m & sometimes weights
Day 4 Easy
Day 5 Warmup
Day 6 Race or Lactic Tolerance e.g. 3 x (300 rest 1min 150m) 12min between sets.

Day 7 Rest

No sessions totaled in this period more than 1500m of reps.
Some examples of sessions performed were:

- 6 x 200m 5-4-3-2-1 in between 24.6 & 26.4s from a slow rolling start.
- 4 x 200 walk 80m flying 100m 10min between sets in about rolling start 23.5 & flying 11.9
- 6 x flying 100m walk back in 10.8-11.3
- 4 x 150m rest 4min in about 17.0 15min then 4 x 120m in about 14.0s
- 2 x 300m 7min 36.6, 37.1 rest 15min 200m 23.9 5min 200m 24.7 2min 200m 26.1 10min 3 x 120m relaxed
- Blocks to 350m in 43.9s

The most specific sessions that a 400m athlete can do that will have a big impact on 400m racing are doing fast short runs in pairs. Darren Clark who was Commonwealth Champion in 1990 & Olympic Finalist in 1984 & 1988 was able to perform sessions such as:

- 300m (35.0s) rest 2min 300m (35.9s) 30min recovery 200m (21.4s) 2min 200m (21.7s)
- 300m 20min 200m 20min 200m in 33.2s, 21.2s, 20.4s from rolling starts
- 3 x 300m full recovery from blocks 32.9s, 33.6s, 33.3s

There are a great variety of sessions and training plans that can be implemented with 400m athletes. It certainly depends very much on the type of athlete. Rick Mitchell might not have been able to back up as well as he did through four rounds of competition if he had been prepared with Cathy Freeman's training program. Cathy may not have developed adequate speed to run as fast as she did if she used a program like Rick Mitchell's. The main thing is that the 400m event should not be prepared for with too big an emphasis on lactic tolerance type training. The athlete needs to develop economy at race speeds, good general conditioning & the strength to be able to maintain good running form when highly fatigued.

Developing Sprinters – A Yearly Plan

By Steve Bennett
B.Sc. (Physiology)
www.oztrack.com

Sprinters need to maintain a high level of speed all year. Over the past few years I have found the best way to develop sprinters is with a double periodized year. This is because they can then be training with high levels of speed all year & working on every area of development in a more effective way for a higher percentage of the year. What follows is the outline of a yearly plan:

44 weeks
Conditioning Phase A 8 weeks
Every 4th week is recovery.

Weight training initially targets hypertrophy & general conditioning. It is usually performed 3 times per week. Interestingly when athletes lift in sets of 8-10 they stay much fresher in terms of their nervous system than later in the year when they are lifting more intensely with sets of 3-4. This means that during the conditioning phase it is much easier to perform quality running without it being effected by flatness from the weight training sessions. Late in the phase sets should decrease from maybe 3 sets of 10 to 3 sets of 8. Athletes should lift upward fast & down slow, they should not lift to the same tempo as a body builder even though the aim of this phase is to attain some muscular hypertrophy.

Plyometrics in this phase should aim to develop power with the longer contact varieties. Standing start bounding e.g. 4 alternate leg bounds & a jump into a sandpit can be performed. Standing long jumps & standing triple jumps can also be performed.

Hill training can be performed over distances of 60-100m and some can involve alternate leg bounding. e.g. run 60m bound 20m.

Athletes should perform two relaxed tempo sessions on grass per week & total between 1200m-2200m in each session. It is essential to keep tempo sessions slow so that they do not effect the quality of training the next day. This means running 100m reps not within 4s of maximum effort. A good tempo session may be something like 4 sets of 6 x 60m with a set of pushups & crunches before each rep. Athletes can rest after each run for 30-60s then start the exercises & have 5min between sets. These sessions build good general conditioning & are a much better alternative for sprinters than jogging for 20min.

Speed development sessions initially focus on improving performance over 30m from a 3 point start. Often what happens is the athletes will find that improvements in strength, bounding & 30m times will happen concurrently throughout the phase.

Strength Phase A 6 weeks
During this phase weight training changes to smaller sets e.g. 3-5 sets of 3-6 reps to target the development of maximum strength. This move can easily negatively effect the quality of running that can be performed the next day. It is ideal to be able to do fast track sessions in the morning & then weight training straight afterward or later on in the same day. In this way it is easier to balance the recovery in the week to maintain quality in faster track sessions. Weights should be continued 3 times a week.

Maximum speed work should expanded to include as well as the 30m runs longer distances of 40m, 50m & 60m. It is best to shift emphasis to 40m then to 50m then to 60m. In the second period the emphasis can start longer & be built up to include some 80m sprints. It is also a good idea to do some flying start runs of 15m to 30m or in & outs over longer distances. Speed sessions can be performed twice a week. It is important to aim to do only as many sprints as you

can perform with quality at maximum effort. Make sure the athlete can back up from the session to the next one & still perform good quality. If the athlete is finding that they can't back up for the next session do less reps , do the runs sub-maximally or do less weights. Balancing this area is a key problem when coaching sprinters.

Plyometrics should progress toward varieties that have shorter duration ground contacts. A good way to do this is by performing running start bounding. e.g. 10m running start then 4 alternate leg bounds & a jump into a pit. They should continue to do longer contact bounding as well. Plyometrics should be done once a week.

Hill training can be continued by decreased to once every 2 weeks. The hill session should be of less volume of shorter hills with some bounding e.g. 2 x 3 x 40m hills with run 20m then bound 20m these can be done like a tempo session with exercises in between sets. It is also a good idea at this stage to start getting used to some speed endurance on the track by doing just 2 fast relaxed 150m reps on the track after the hill session. This will make it easier to transition to more work on the flat in the next phase.

Athletes should continue performing two simple tempo sessions on grass per week & total between 1200m-2200m in each session.

Power Phase A 4 weeks

Weight Training 2-3 times a week moves toward a power focus. A small volume of strength lifts are maintained. One gym session a week is aimed at developing power with exercises such as:
- stiff legged bounces with a light weight e.g. 20kg
- jump up onto a box with less than 30% of 1RM half squat.
- stomping step ups with less than 30% of 1RM half squat.
- power cleans

These are often done in a circuit type situation with some heavy ¼ squats includes for a contrast effect.
Plyometrics should progress toward even quicker ground contacts. This is done with the performance of alternate leg speed bounding. These are done with a 10m running start and the aim is to get as much power into the track as quickly as possible e.g. taking the minimum number of strides to go 30m but also in a minimum time. The athlete needs to aim to strike the ground well underneath the body.
Hill training is replaced with small volume speed endurance sessions e.g. 150m rest 8min 150min rest 8min 150m rest 2min 150m.
Maximum speed sessions should be expanded to include sprints of up to 60m. They can also start to include some over-speed either using a strong tailwind or an assistance system. These should be performed in small volumes that the athlete is used to using.
Athletes should continue performing two simple tempo sessions on grass per week & total between 1200m-2200m in each session.

Competition Phase A 3 weeks

Weight training sessions can be performed once a week with a very small amount of a complex lifts just to maintain strength e.g. power cleans as well as ¼ squats are performed to maintain strength.
Plyometrics are stopped to enhance the athlete's nervous system freshness.
Maximum speed sessions are performed of the same variety as the power phase but the emphasis needs to be on racing. The 72hrs leading into the race need to be free of anything that could effect the nervous system on the day of the race. This means almost no intense high cadence training, plyometrics or heavy lifting.
Tempo sessions once to twice a week with 800m-1600m in each.
Competition.

Conditioning Phase B 6 weeks

Similar to Conditioning A but the athlete should be entering this phase with higher levels of speed. They should do the smaller volume hill session from the strength phase e.g. e.g. 2 x 3 x 40m hills with run 20m then bound 20m with full recoveries and exercises between sets.
Maximum Speed Development can be of a greater variety between distances of 20m & 60m. But most work should stay at 40m.
Plyometrics should be of the long contact variety and can be combined in a session with block starts.
Some alactic capacity speed sessions should be performed involving the use of larger numbers of short repetitions e.g. 3 x 4 x 60m at less than 95% effort with 2min between reps and 10min between sets.

Strength Phase B 6 weeks

Similar to Strength A. The athlete should aim to become even stronger in this phase.
Hills should be replaced in this phase with speed endurance sessions that are initially longer repetitions e.g. 2 x 300m but progress toward shorter repetitions of 100-150m.
Maximum speed development should stay the same as in Conditioning B.
Plyometrics should progress toward quicker contacts.
Some alactic capacity speed sessions should be performed involving the use of larger numbers of short repetitions e.g. 3 x 4 x 60m at less than 95% effort with 2min between reps and 10min between sets.

Power Phase B 8 weeks

Similar to Power A
Plyometrics is speed bounds & some higher intensity plyometrics in low volumes e.g. over hurdle bounces e.g. in my squad an athlete did 6 x 2 plyo-hurdles at heights up to 107cm.
Maximum speed work should increase in distance & could re-introduce over-speed.
It is important to do block starts & reaction time practice during this period.
Speed Endurance should focus on progressively shorter repetitions down to sessions like 2 sets of 2-3 sets of flying start 60m-80m runs with rests between of 3min and 20min between sets.
Some competition but not so frequent that the training plan is disrupted.

Competition Phase B 8 weeks

Mental & physical freshness for races is the highest priority.
Gym once a week should focus on maintenance of strength with a small range of complex lifts.
Speed sessions should focus on technical aspects or extra speed may be chased using over-speed methods but this is not a good time of year to sustain an injury.
Speed Endurance should be enhanced from appropriate amounts of racing.
Tempo sessions of 800m-1600m should be continued once to twice a week.

Summary

The aim is to perform the following simultaneously as the competition phase approaches during each half of the year:
- decreasing contact times of plyometric activities.
- decreasing total volume of weights & aim finally for improvement in power.
- extending the distance of sprints from blocks.
- decreasing the distance of speed endurance.
- decreasing the volume of relaxed tempo sessions.
- decreasing total volume of all training for major races
- introducing some over-speed when appropriate late in the preparation.
- build confidence & mentally preparedness for racing with block starts, reaction drills etc.