**What is speed?**

Speed is the quickness of movement of a limb, whether this is the legs of a runner or the arm of the shot putter. Speed is an integral part of every sport and can be expressed as any one of, or combination of, the following: maximum speed, elastic strength ([power](http://www.brianmac.co.uk/power.htm)) and speed endurance.

**How is speed influenced?**

Speed is influenced by the athlete's [mobility](http://www.brianmac.co.uk/mobility.htm), special [strength](http://www.brianmac.co.uk/strength.htm), strength [endurance](http://www.brianmac.co.uk/enduranc.htm) and [technique](http://www.brianmac.co.uk/skills.htm).

**Energy system for speed**

[Energy](http://www.brianmac.co.uk/energy.htm) for absolute speed is supplied by the [anaerobic alactic pathway](http://www.brianmac.co.uk/energy.htm). The anaerobic (without oxygen) alactic (without lactate) [energy system](http://www.brianmac.co.uk/energy.htm) is best challenged as an athlete approaches top speed between 30 and 60 metres while running at 95% to 100% of maximum. This speed component of anaerobic metabolism lasts for approximately eight seconds and should be trained when no [muscle fatigue](http://www.brianmac.co.uk/musclefatigue.htm) is present (usually after 24 to 36 hours of rest)

**How do we develop Speed?**

The [technique of sprinting](http://www.brianmac.co.uk/sprints/index.htm) must be rehearsed at slow speeds and then transferred to runs at maximum speed. The stimulation, excitation and correct firing order of the motor units, composed of a motor nerve (Neuron) and the group of muscles that it supplies, makes it possible for high frequency movements to occur. The whole process is not very clear but the complex coordination and timing of the motor units and muscles most certainly must be rehearsed at high speeds to implant the correct patterns.

[Flexibility](http://www.brianmac.co.uk/mobility.htm) and a correct [warm up](http://www.brianmac.co.uk/warmup.htm) will affect [stride length and frequency](http://www.brianmac.co.uk/economy.htm) (strike rate). Stride length can be improved by developing muscular strength, power, strength endurance and running technique. The development of speed is highly specific and to achieve it we should ensure that:

* Flexibility is developed and maintained all year round
* Strength and speed are developed in parallel
* Skill development (technique) is pre-learned, rehearsed and perfected before it is done at high speed levels
* Speed training is performed by using high velocity for brief intervals. This will ultimately bring into play the correct neuromuscular pathways and energy sources used

**When should speed work be conducted?**

It is important to remember that the improvement of running speed is a complex process that is controlled by the brain and nervous system. In order for a runner to move more quickly, the leg muscles of course have to contract more quickly, but the brain and nervous systems have to learn to control these faster movements efficiently. If you maintain some form of speed training throughout the year, your muscles and nervous system do not lose the feel of moving fast and the brain will not have to re-learn the proper control patterns at a later date.

In the training week, speed work should be carried out after a period of rest or light training. In a training session, speed work should be conducted after the warm up and any other training should be of a low intensity.

**Speed Workouts**

|  |  |
| --- | --- |
| Event | Speed Session |
| 100 metres | a) 10 × 30 metres at race pace from blocks with full recoveryb) 3 to 4 × 80 metres at race pace with full recovery |
| 800 metres | a) 5 × 200 metres at goal race pace with 10 seconds recoveryb) 4 × 400 metres at 2 to 3 seconds faster than current race pace with 2 minutes recovery |
| 1.5 km | a) 4 × 400 metres at goal race pace with 15 to 10 sec recoveryb) 4 to 5 × 800 metres at 5 to 6 seconds per 800 metres faster than goal race pace with 6 minutes recovery |
| 5 km | a) 4 to 5 × 800 metres at 4 seconds per 800 metres faster than goal race pace with 60 seconds recoveryb) 3 × 1 mile at 6 seconds per mile faster than goal race pace with 2 minutes recovery |
| 10 km | a) 3 × 2000 metres at 3 seconds per 200 metres faster than goal race pace with 2 minutes recoveryb) 5 x 5 min intervals at current 5km race pace with 3 minutes recovery |
| Marathon | a) 6 x 1 mile repeats at 15 seconds per mile faster that goal race pace with 1 minute recoveryb) 3 × 3000 metres at 10km race pace with 6 minutes recovery |

The following are sample speed workouts for competitive runners (Dr Karp 2012)[[3]](http://www.brianmac.co.uk/speed.htm%22%20%5Cl%20%22ref)

|  |  |
| --- | --- |
| Event | Session |
| 1 Mile | a) 8 x 400m - mile pace - recovery 2 mins b) 2 x 6 x 200m - mile pace - recovery 30 secs/rep 2 mins/set |
| 5 km | a) 5 x 800m - 3-5k pace - recovery 2 minsb) 3 x 1 mile - 5k pace - recovery 3 mins |
| Marathon | a) 4 x 2k - 10k pace - recovery 3 minsb) 5 miles [tempo pace](http://www.brianmac.co.uk/energy.htm#tempo) |

All speed workouts should include an appropriate [warm up and cool down](http://www.brianmac.co.uk/warmup.htm).

**Reaction Speed Drill**

The athletes start in a variety of different positions - lying face down, lying on their backs, in a push up or sit up position, kneeling or seated. The coach standing some 30 metres from the group then gives a signal for everyone to jump up and run towards him/her at slightly faster than race pace. Repeat using various starting positions and with the coach standing in different places so that the athletes have to change directions quickly once they begin to run. [Speed reaction drills](http://www.brianmac.co.uk/reaction.htm) can also be conducted whilst controlling an item (e.g. football, basketball, hockey ball) with an implement (e.g. feet, hands, hockey stick).

**Acceleration Training**

Murray (2005)[[1]](http://www.brianmac.co.uk/speed.htm%22%20%5Cl%20%22ref) looked at weighted sledge training and their effect on sprint acceleration and they concluded that training with a weighted sledge will help improve the athlete's acceleration phase. The session used in the research was 4 x 20m and 4 x 50m maximal effort runs.

Lockie et al. (2003)[[2]](http://www.brianmac.co.uk/speed.htm%22%20%5Cl%20%22ref) investigated the effects of various loadings and concluded that when using a sledge a light weight of approx. 10-15% of body weight should be used so that the dynamics of the acceleration technique are not negatively effected.

Starts over 10-20 metres performed on a slight incline of around five degrees have an important conditioning effect on the calf, thigh and hip muscles (they have to work harder because of the incline to produce movement) that will improve sprint acceleration.

**Sprinting Speed**

[Downhill](http://www.brianmac.co.uk/hilltrain.htm) sprinting is a method of developing sprinting speed following the acceleration phase. A hill with a maximum of a 15° decline is most suitable. Use 40 metres to 60 metres to build up to full speed and then maintain the speed for a further 30 metres. A session could comprise of 2 to 3 sets of 3 to 6 repetitions. The difficulty with this method is to find a suitable hill with a safe surface.

Over speed work could be carried out when there are prevailing strong winds - run with the wind behind you.

**Speed Principles**

The general principles for improved speed are as follows:

* Choose a reasonable goal for your event, and then work on running at velocities which are actually faster than your goal over short work intervals
* Train at goal pace in order to enhance your neuromuscular coordination, [confidence](http://www.brianmac.co.uk/selfcon.htm) and stamina at your desired speed
* At first, utilise long recoveries, but as you get fitter and faster shorten the recovery periods between work intervals to make your training more specific and realistic to racing. Also move on to longer work intervals, as you are able
* Work on your [aerobic capacity](http://www.brianmac.co.uk/vo2max.htm) and [lactate threshold](http://www.brianmac.co.uk/lactic.htm), conduct some easy pace runs to burn calories and permit recovery from the speed sessions
* Work on your [mobility](http://www.brianmac.co.uk/mobility.htm) to develop a range of movement (range of motion at your hips will effect speed) and assist in the [prevention of injury](http://www.brianmac.co.uk/injury.htm)

**Seven Step Model**

The following is seven step model for developing playing speed.

1. Basic training to develop all qualities of movement to a level that will provide a solid base on which to build each successive step. This includes programs to increase body control, strength, muscle endurance, and sustained effort (muscular and cardiovascular, anaerobic and aerobic)
2. Functional strength and explosive movements against medium to heavy resistance. Maximum power is trained by working in an intensity range of 55 to 85% of your maximum intensity ([1 RM](http://www.brianmac.co.uk/maxload.htm))
3. Ballistics to develop high-speed sending and receiving movements
4. [Plyometrics](http://www.brianmac.co.uk/plymo.htm) to develop explosive hopping, jumping, bounding, hitting, and kicking
5. Sprinting form and speed endurance to develop [sprinting technique](http://www.brianmac.co.uk/sprints/index.htm) and improving the length of time you are able to maintain your speed
6. Sport loading to develop specific speed. The intensity is 85 to 100% of maximum speed
7. Over speed training. This involves systematic application of sporting speed that exceeds maximum speed by 5 to 10% through the use of various over speed training techniques

**Speed Program**

For a number of sports acceleration and speed over a short distance (10 to 50 metres) is very important e.g. [American Football](http://www.brianmac.co.uk/usafootball/index.htm), [Basket Ball](http://www.brianmac.co.uk/basketball/index.htm), Baseball, Cricket, Field Hockey, [Rugby](http://www.brianmac.co.uk/rugby/index.htm), [Soccer](http://www.brianmac.co.uk/football/index.htm) etc. An explanation on how to develop a program to meet this need can be found on the [40 yard Dash](http://www.brianmac.co.uk/dash.htm%22%20%5Ct%20%22) page.

**Referenced Material**

1. MURRAY, A. (2005) The effects of resisted sled-pulling sprint training on acceleration and maximum speed performance. *J Sports Med Phys Fitness*, 45 (3), p. 284-90
2. LOCKIE, R.G. et al. (2003) Effects of resisted sled towing on sprint kinematics in field-sport athletes. *Strength Cond Res.*, 17 (4), p. 760-767
3. KARP, J. (2012) The power to succeed, *Athletics Weekly*, November 29 2012, p.42-43

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