VELOCITY BASED TRAINING

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Resistance exercise training programs elicit improvements in strength by structuring and manipulating traditional training variables like, but not limited too, sets, reps, load, intensity, interval, and exercise selection. The specific structuring and application of these variables result in morphological adaptations including, but not limited too; increased muscle fiber size, change in fiber structure and architecture, CNS adaptations like increased activation of motor units within a muscle and increased rate of firing of motor units.

At METfit we provide our members with as many scientifically backed strength training best practices and advice as possible. VBT(Velocity Based Training) is one of the many training strategies we use to increase strength, power, and size.

Several studies have revealed important benefits to this type of training.

- Those training with maximal velocity attained better strength and power results than those who do not train with maximal intended velocity (3);
- Velocity decreases fairly linearly across a set of traditional strength training exercises like
  bench presses and squats (5);
- Velocity is closely related to %1RM (7);

To effectively utilize VBT a comprehensive understanding of the changes in barbell velocity that occur during training is a critical component of developing effective VBT training prescriptions.

Measuring Velocity.

At METfit we use a LPT(Linear Position Transducer) to measure velocity. A LPT is an electronic device that converts the linear motion of an object into an electronic signal by attaching a thin filament cable to the barbell. The LPT can directly measure displacement (linear movement of the bar) and time. Tracking these two values can be used to calculate several very valuable training metrics.

• Average velocity	• Range of motion	• Peak velocity location
• Peak velocity	• Rep duration	

What do the measures tell you?

- Average velocity
    - The mean velocity over the ROM.
        - A good measure of strength training terminal movements. ie. Squats, Bench Press, Dead-Lifts.
- Peak velocity
    - The maximum velocity reached during the rep.
        - A good measure of ballistic training movements (ie. jumps and throws). Movements that include rapid full acceleration through the end of ROM.
- Range of motion
    - The total linear displacement of the movement
- Rep duration
    - The time is seconds needed to complete each rep.
- Peak velocity location
    - The location within the ROM where the peak velocity was achieved as a %

How do these measurements aid in coaching and program design?

The recent increase in the volume of velocity related training research has provided valuable normative values aiding in the prescription of velocity based training programs. The following chart provides normative barbell velocities (m/s) from different sources for several different exercises at differing percentages of

Exercise	60% 1RM	70% 1RM	80% 1RM	90% 1RM	100% 1RM
Bench press (37)	0.77 (0.07)	0.61 (0.06)	0.46 (0.05)	0.31 (0.05)	0.17 (0.04)
Bench press (21)	0.80 (0.05)	0.64 (0.05)	0.48 (0.04)	0.33 (0.04)	0.19 (0.04)
Bench pull (37)	1.06 (0.09)	0.92 (0.09)	0.79 (0.08)	0.65 (0.07)	0.52 (0.06)
Squat (17)	0.56	0.47	0.37	0.32	< 0.3
Deadlift (18)	0.50		0.30 85%=		
Exercise	**55% 1RM**	**65% 1RM**	**75% 1RM**		
Bench press (21)	0.87 (0.05)	0.71 (0.05)	0.55 (0.04)		
Bench press (14)	0.87 (0.07)	0.72 (0.08)	0.57 (0.07)		

Table 1. Some average velocity data for key strength exercises.

the lifters 1RM (%1RM).

Exercise	50% 1RM	60% 1RM	70% 1RM	80% 1RM	90% 1RM	100% 1RM
Squat (39)	0.80 (0.10)	0.72 0.09	0.62 (0.10)	0.58 (0.14)	0.54 (0.10)	NA
Bench press (28)	1.47 (0.08)		1.01 (0.09)		0.59 (0.12)	

Table 2. Some peak velocity data for key strength exercises.

Autoregulation and using velocity decline to determine End of Set (EOS).

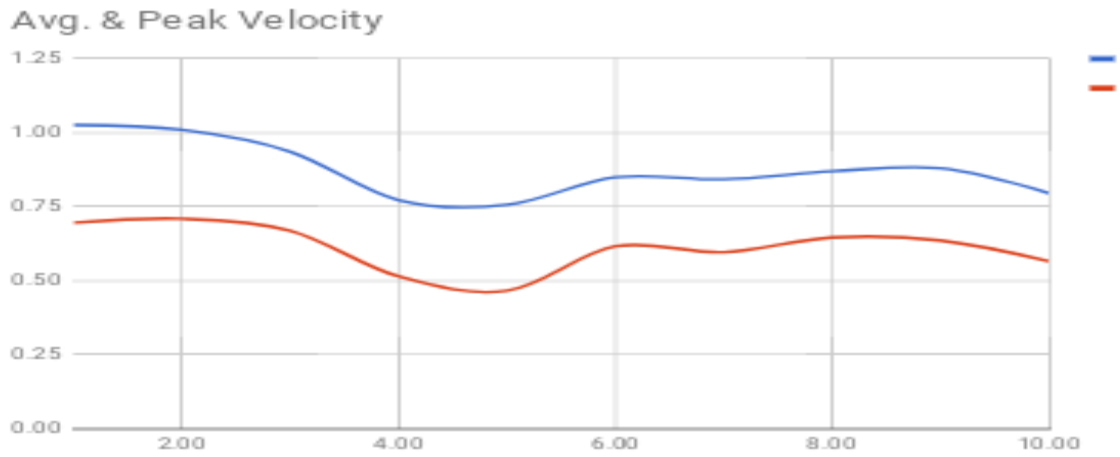
Velocity measurement provides real time feedback to METfit coaches. The metrics can be used to coach lifters during a set. Awareness of rep speed provides a unique awareness to lifters improving their ability to modulate workload and intensity.

In the chart below Rep # 4 showed an initial decline in velocity. The bar speed data can be viewed by the lifter in real time at the completion of each rep. In this case the lifter was able to self modulate his intensity and increase his bar speed for 7, 8, and 9.

Bar speed dropped by 20% from rep 1 on the 10th rep. 20% decline in velocity from the fastest to the slowest rep is a good metric to determine end of set (EOS).

		AVERAGE of Average Velocity (m/s)	AVERAGE of Peak Velocity (m/s)
Buffalo Speed Bench	**1.00**	0.70	1.03
	2.00	0.71	1.01
	3.00	0.67	0.94
	4.00	0.52	0.77
	5.00	0.47	0.76

	6.00	0.62	0.85
	7.00	0.60	0.84
	8.00	0.65	0.87
	9.00	0.64	0.88
	10.00	0.57	0.80

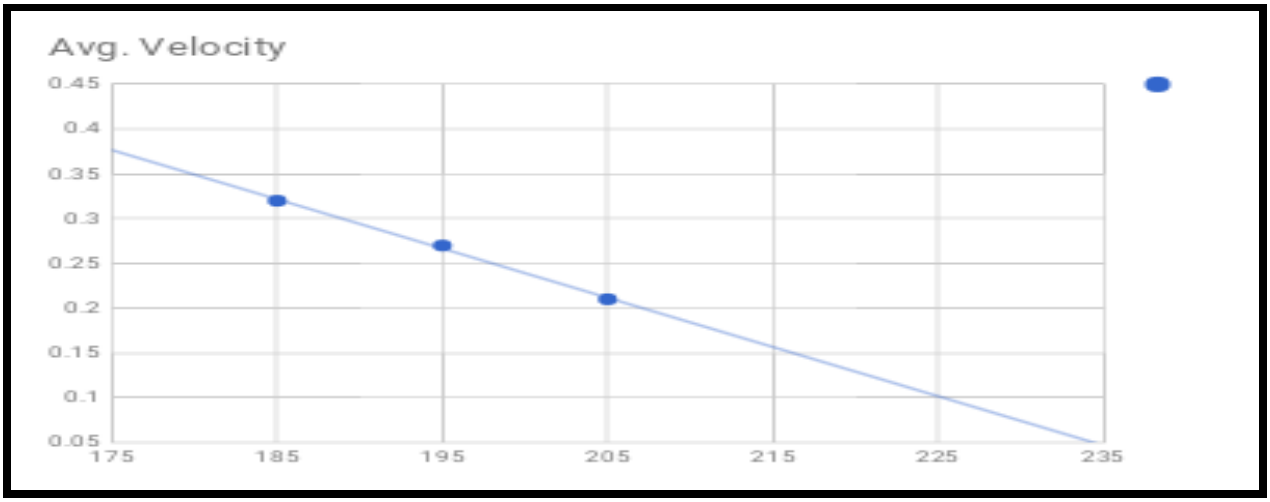


Estimating 1RM using velocity

By taking advantage of the inverse linear relationship between load and velocity allows for the accurate estimation of 1RM using sub max loads. This process uses the same assumptions previously discussed for using submax HR to estimate Maximum HR and energy expenditure using regression.

In the example below a METfit member performed 3 sub max lifts at 75%, 80%, 85% of her 1RM. The mean velocity for each set is plotted against load. A linear regression line is extended to the expected stall speed for that particular lift, dead-lift stall speed for experienced lifters (See chart above - between .05 - .9 m/s). Using a stall speed of .075 indicates a 1RM of approx. 230lbs. In practice at METfit estimating a 1RM using barbell velocity measurements yields very precise 1RM estimates, surpassing the accuracy of many widely used non-velocity based 1RM estimation equations (ie. Brzycki, Epley, Lander)

Deadlift	**185**	0.32
	195	0.27
	205	0.21



If you would like to try a VBT session at METfit contact us at info@metfit.org or Coach Ron Drago at marinek9@gmail.com.

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