U.S. TRACK & FIELD AND CROSS COUNTRY COACHES ASSOCIATION

400 Meter Hurdle Training

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400 Hurdle Training Design Consideration

- Coordination
- Acceleration
- Speed
- Mechanics
  - Front Side
- Strength
- Power
- Flexibility
- Psychological
- Endurance

Coordination

- Hurdling is a learned SKILL
- Requires precise movements at high rates of speed

Speed

- Closely linked with coordination
- The ability to move the body or parts of the body at high rates of speed;
- To express power through those movements

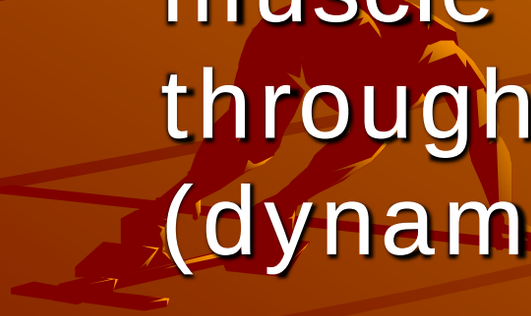
Strength / Power

- The ability to overcome inertia
- Qualities primarily responsible
  - Maximal strength
  - Elastic strength


Asafa Last Slide

Flexibility

- Good hurdlers possess good degrees of flexibility in the hips and ankles
- Increased flexibility allows for decreased muscle resistance and easier movement throughout the range of motion (dynamic flexibility)

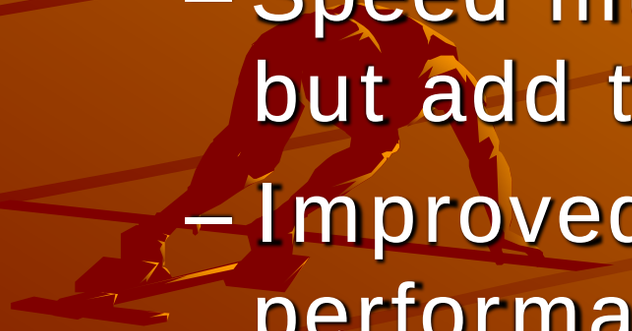


Psychological

- Common psychological traits include
  - High self image
  - Aggressive attitude
  - Confidence in competition
  - Relaxed in pressure situations

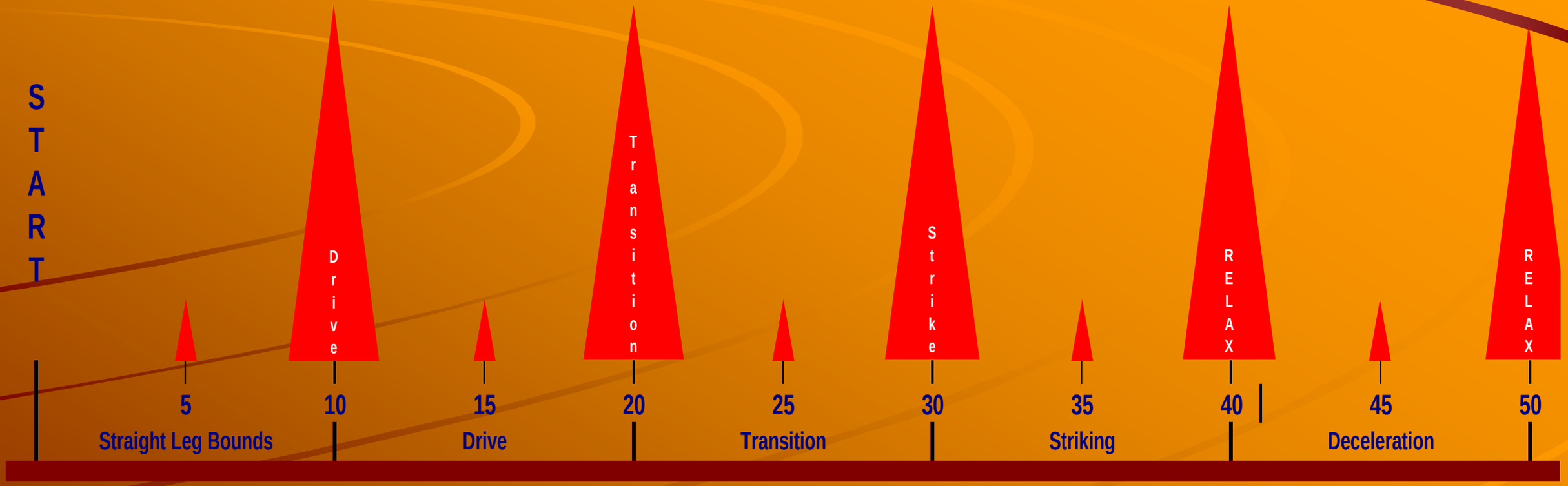
Speed

- The ability to move a body or it's parts through a given range of motion in the least time.
  - Speed must not influence technical efficiency but add to it.
  - Improved speed will not always improve performance unless it is expressed within the confines of good technique.

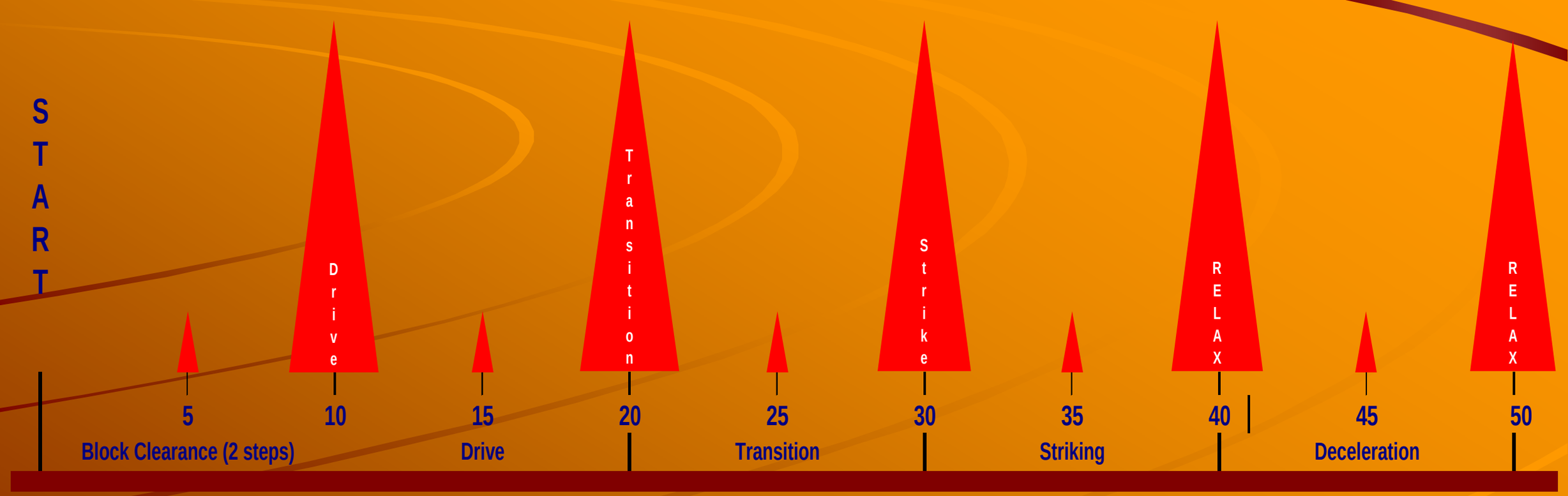


Speed

- Acceleration: The rate of speed increase



Acceleration Drill Set Up



Acceleration Drill Set Up

400 Hurdles Stride Patterns

Even number of strides

Lead leg in back block

Odd number of strides

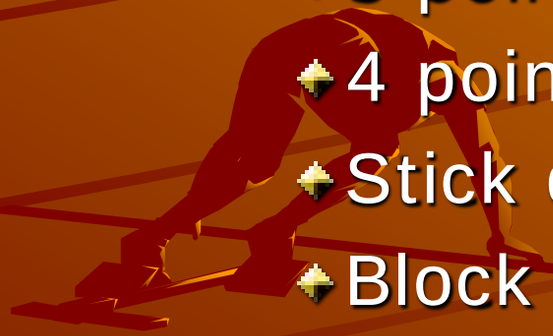
Lead leg in front block

H1 = 45 meters

H are 35 meters apart

Training Considerations

- Start
  - Alternate front leg position in all acceleration work
    - Standing
    - 3 point
    - 4 point
    - Stick drill
    - Block work



Speed

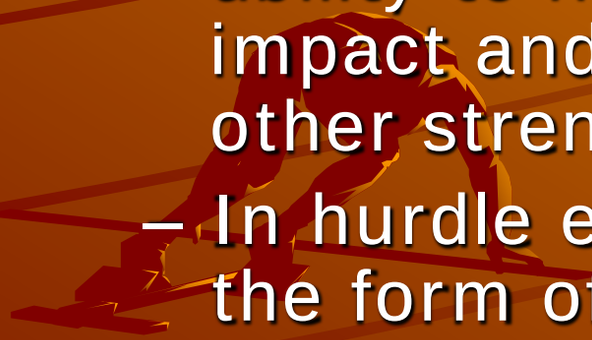
- Absolute Speed: defined as maximal velocity attainable. This quality should not be confused with acceleration. Absolute speed training activities involve attaining and maintaining maximal velocities for short periods of time

Strength

- The ability to apply force
  - Power = force x velocity
  - Strength must be understood in terms of power for hurdling

Types of Strength

- Absolute Strength (high force)
  - The ability to produce great force in a static or dynamic sense. Speed of movement is not a concern in absolute strength exercises.
  - Absolute strength qualities greatly determine one's ability to hold postural alignment under stress and impact and are an inherent and contributing part of all other strength qualities needed in movement.
  - In hurdle events, absolute strength is best evaluated in the form of relative strength capabilities (force produced per unit of bodyweight).
  - Most absolute strength training activities involve high resistances



Types of Strength

- General Strength
  - Defined as the ability to overcome the resistance of one's own body.
  - General strength training activities involve no external loading, using bodyweight as the sole load.

Types of Strength

- Elastic Strength (high velocity and force)
  - Defined as the ability to produce force using the stretch reflex and the stretch shortening cycle.
    - Training programs must consider development of this quality to be a priority.
    - Most elastic strength training involves plyometric and/or multi-jump activities.

Elastic Energy Utilization

- Forces produced via elastic energy have little energy cost

Types of Strength

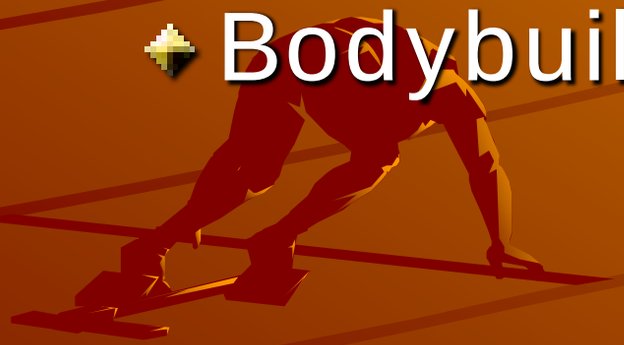
- Strength Endurance
  - Defined as the ability to sustain force production.
  - Strength endurance is normally a concern in stabilizing and postural muscle groups, which must be able to remain effective throughout the course of the event.

Means and Methods of Strength Training

- Weight Training
- General Strength
- Multi-Throws
- Medicine Ball Routines
- Multi-Jumps
- Special Strength Activities
- Every activity we do makes us stronger

Weight Training

- Olympic Lifts
- Static Lifts
- Ballistic Lifts
- Bodybuilding Lifts



Weight Training

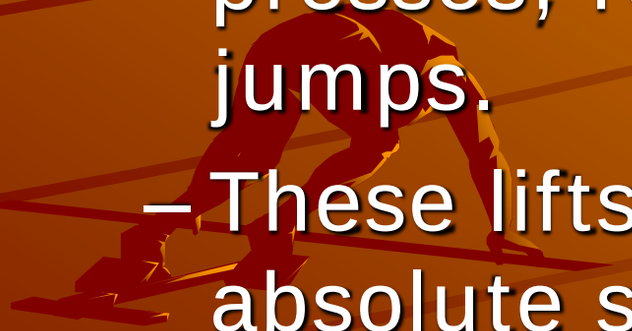
- Olympic Lifts
  - Competitive lifts such as the clean, snatch, and jerk. Also included in this group are similar or related movements such as various types of pulls.
  - Olympic lifts are a major muscle group oriented activity.
  - Olympic lifts develop absolute strength, power, and coordination.

Weight Training

- Static Lifts
  - Traditional weight lifting exercises involving major muscle groups.
  - Most squatting and pressing movements fit into this category.
  - Characteristically involve high resistances and low speeds of movement.
  - Static lifts are a primary tool for absolute strength development, and enhance postural qualities and anchoring ability when technique and loading are appropriate

Weight Training

- Ballistic Lifts
  - Fast, repeated, and weighted movements, usually involving elastic qualities.
  - Examples of these lifts would be repeated presses, repeated jerks, or all types of loaded jumps.
  - These lifts enhance power, elastic strength, and absolute strength, but more importantly greatly resemble the demands of competition.



Weight Training

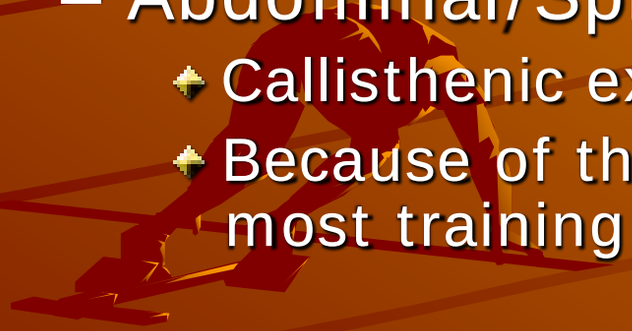
- Bodybuilding Lifts
  - Traditional and special weightlifting exercises performed in higher repetition/lower resistance/short recovery formats.

General Strength Exercises

- Exercises that involve no external loading.
  - Bodyweight serves as the only loading agent.
  - General strength exercises improve coordination, body control, and active flexibility. They also can be used to improve muscular strength and strength endurance.

General Strength Exercises

- Categories of General Strength
  - Calisthenics
    - Gross body movements that often they involve body positions that create resistance or challenge ranges of motion. They are typically performed in circuit fashion. Traditional exercises such as pushups, dips, situps, and squats, fall into this category. This type of work is commonly used to develop energy system and endocrine fitness.
  - Abdominal/Spinal Work
    - Callisthenic exercises designed to address these areas.
    - Because of the importance of this body region to performance, most training systems address this area separately from the above.



General Strength Exercises

- Categories of General Strength
  - Stabilization Routines
    - Develop the ability to stabilize joints and gross muscle groups during activity.
    - These muscle groups must possess enough strength endurance to function throughout the course of the event.
    - Often these exercises require joints or body parts to remain stationary under circumstances of loading or instability. At other times they may require very slow, uniform movements of body parts.
    - Improvement of balance often results from this type of work. Pilates, the Green gymnastic ball series and traditional calisthenics performed in a slow format fall into this category.

General Strength Exercises

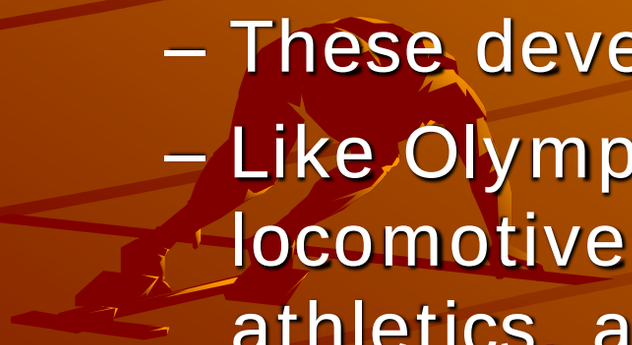
- Categories of General Strength
  - Connective Tissue/Fascia Routines
    - Exercises that create great tension in the connective tissue, under conditions of very slow movement. These also address muscle tissue as well, and help to improve flexibility and muscular strength and endurance.
    - Examples of this type of work are duck walks, squat walks, and many of traditional rehabilitation exercises that challenge range of motion in a forceful way

Medicine Ball Routines

- Medicine Ball Routines include various exercises using the medicine ball as loading.
  - Examples include various catch/throw combinations, abdominal and spinal exercises with the medicine ball, and callisthenic type exercises using the ball as a light load.
    - These exercises are usually performed in circuit fashion.
    - Produces many of the same benefits of general strength work.
    - Exercises can be chosen to activate and educate small muscle groups and enhance the efficiency of large muscle groups.
    - Can serve as a primary strength training modality for young athletes, and a primary recovery modality for older athletes.
    - Can be used to enhance postural strength and the body's ability to withstand impact by catching the thrown ball

Multi-Throw Routines

- Multi-throw Routines are high intensity throws, performed from various positions, using a shot or relatively heavy medicine ball as a load.
  - Examples would include overhead back throws, underhand forward throws, rotational throws, and throws from the lunge position.
  - These develop power and coordination.
  - Like Olympic lifts, they require muscle stabilization and locomotive activity that is very similar to what we see in athletics, and thus are very specific to performance.
  - They are typically used when a low risk power/coordination activity is required.



Multi-Jump Routines

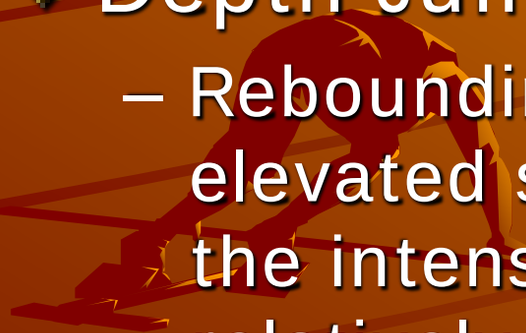
- Multi-jumps are jumping activities that develop elastic strength. They are highly specific to the jumping events, so they serve as an important special strength and technical development tool as well.

Multi-Jump Routines

- We can group multi-jumps into the four categories
  - Short Jumps
    - Simple jumps of low to medium intensity, with displacement, and specific technical demand. Normally we see 1-5 contacts per set.
      - Examples would be standing long jumps, standing triple jumps, or hurdle hops.
  - In-Place Jumps
    - Jumps of low to medium intensity without displacement.
      - Examples would include tuck jumps, lunge jumps, squat jumps, and rotational jumps. Normally we find 8-20 contacts per set, and a total of 150-300 contacts per session. These are often done in circuit fashion.

Multi-Jump Routines

- Extended Bounds
  - Jumps performed over significant distances, exhibiting displacement and specific technical demand.
    - Examples include single leg hops, alternate bounds, straight leg bounds, and extended hurdle hops. These are medium to high intensity exercises, and are typically performed over distances.
- Depth Jumps
  - Rebounding efforts performed after a fall from some elevated surface. The height of the elevated surface dictates the intensity of the exercise, and most depth jumps are of relatively high intensity.
    - Examples would be a fall from a box with a rebound onto another box, into a hurdle hop, or into a standing long jump.



Special Strength Exercises

- Special Strength Exercises are exercises that technically mimic the competitive movement to a great degree, performed under loads.
  - Examples include long jumps or sprints performed while wearing a weighted vest, resisted runs, throws using heavy implements, or specialized weightlifting exercises.
  - While special strength exercises have value, we should not consider them a substitute for other types of strength development.

Strength Program Design

- Design the strength program to support and enhance the overall objective of training.
  - Do not design the strength program in isolation. (This is the most common error)

Endurance

- General Endurance
  - The capacity to perform an activity involving many muscle groups and systems for a prolonged period
- Specific Endurance
  - Anaerobic work to develop endurance at intensities specific to the performance intensity of the event.

General Endurance Example

- Extensive Tempo Running is run training designed to improve aerobic power and anaerobic capacity.
  - These runs are normally done at approximately 70-80% intensity, with recoveries of 2-3 minutes.
  - Runs normally range from 100-200 meters. Workout constructs often include various combinations of sets and repetitions

Specific Endurance

- Specific Endurance is only one aspect of sprint performance
  - Cannot be viewed in isolation
  - Improvements come as a result of improvements in sprint technique, strength, and power

What is Specific Endurance?

- Many terms have been employed to describe the quality of Specific Endurance
  - Speed Endurance
  - Intensive Tempo (Lactacid Capacity)
  - Special Endurance I (Lactacid Power)
  - Special Endurance II (Lactacid Tolerance)

Speed Endurance

- A combination of two major biomotor abilities
  - Speed: the ability to apply high speed of movement to a body or body part.
  - Endurance: the ability to apply force for long time periods.

Means and Methods of Speed Endurance

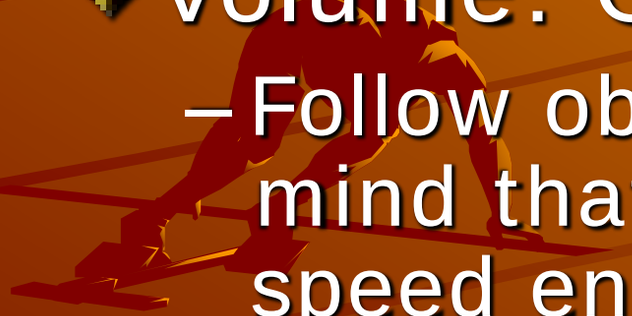
- Short Speed Endurance
  - Alactic power and capacity…..greater speed emphasis
    - e.g.: 4x4x60m [3-4’, 6-8’]
  - Glycolytic power and capacity….greater speed emphasis working in higher state of fatigue
    - e.g.: 4x4x60m [60-90”, 4-6’]
- Long Speed Endurance
  - Lactacid power and capacity

Intensive Tempo (Lactacid Capacity)

- Intensity: 80-89%
- Length of runs: > 80m
- Recoveries: 30 seconds to 6 minutes
- Volume: Generally 800m-2400m.
  - Follow objectives of training session keeping in mind that when mechanics fail, the quality of speed endurance running will not be enhanced.

Special Endurance (Lactacid Power)

- Intensity: 90%+
- Length of runs: 80m-600m
- Recoveries: 8 minutes +
- Volume: Generally 400-1000m.
  - Follow objectives of training session keeping in mind that when mechanics fail, the quality of speed endurance running will not be enhanced.

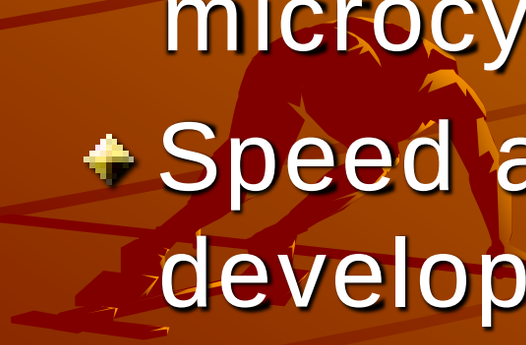


Speed vs. Endurance

- Which is most important?
  - There are no hard and fast answers
  - Better performance is the result of the artistic application of all training
  - Never view training of any ability in isolation.
    - Speed effects endurance
    - Strength effects speed and endurance
    - Mobility effects speed, coordination…

Some principles of Specific Endurance

- Speed should precede Endurance in the session
- Speed should precede Endurance in the microcycle
- Speed and Endurance should be developed together in the macrocycle

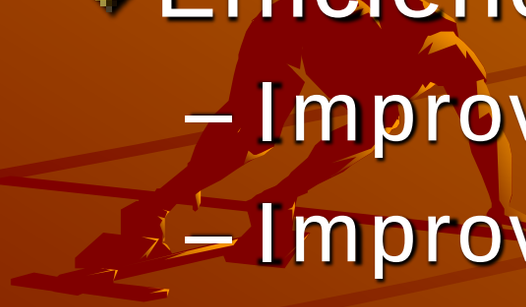


Goal of Specific Endurance

- To prepare the athlete to perform the race distance at the highest possible speed.
- To prepare the athlete to perform the race distance at the highest possible speed over several days (rounds of competition).

The Anaerobic Process

- In hurdling we are interested most in the ATP-CP + LA system.
  - 15-60 seconds duration
- Efficiency is our interest
  - Improving capacity of the system
  - Improving power of the system



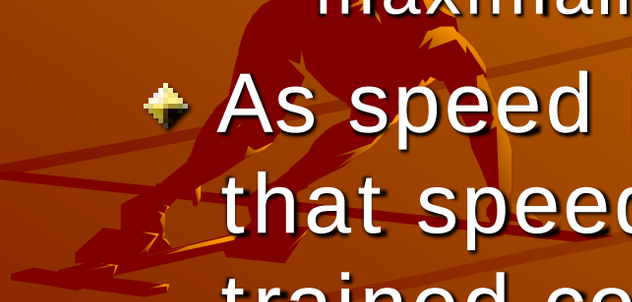
Conclusions regarding Specific Endurance

- By working at sub-maximal intensities we save energy and utilize fewer muscle fibers.
  - Allows the athlete to keep active only a percentage of the muscle fibers, consuming fewer phosphates.

- It thus becomes important to stress training methods aimed at improving the power and capacity of the process so the athlete can improve their performance and still work at a rate that is sub-maximal.

The Specific Endurance Training Process

- The basic ingredient must always be maximal speed
  - The higher the level of max speed, the faster will be the athlete's velocity when performing sub-maximally
- As speed is improved, the ability to endure that speed at sub-maximal levels must be trained concurrently. (Speed Endurance developed concurrently with Speed)



Progression in speed and endurance training

- Develop sound sprinting mechanics
  - The basis for improving speed endurance
- Introduce runs at higher intensities over short distances
- Develop speed over increasing distances
- Introduce sub-maximal runs over distances of increasing length (50m, 60m,...,120m, 150m)
  - Only allow athlete to run as far as their technique will allow.

PLANNING TRAINING - ENERGY SYSTEM

ENERGY SYSTEM TRAINING BREAKDOWN FOR SPRINT AND HURDLE EVENTS

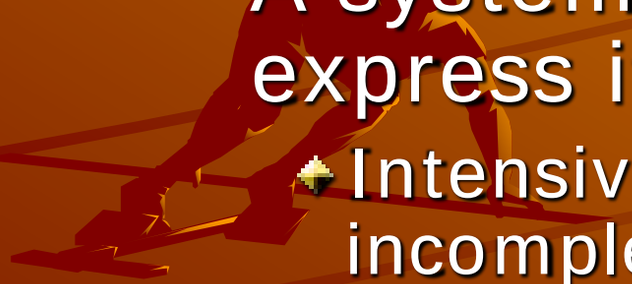
Terminology	Length of Run	Component	Energy System	% of Predicted Performance	Rest Interval Between Reps/Sets	Daily Volume Ranges 100/200/ 110/100mH	Daily Volume Ranges 400/400mH
ABSOLUTE SPEED	20-80m	Speed (s) Anaerobic power	Anaerobic Alactic	90-95% 95 - 100%	3-5 / 6-8 min 3-5 / 6-8 min	300-800m 300-500m	300-900m 300-600m
SPEED ENDURANCE	50-80m	Alactic Short Speed End. (ASSE)	Anaerobic Alactic	90 - 95% 95 - 100%	1-2 / 5-7 min 2-3 /7-10 min	300-800m 300-800m	600-1200m 600-1200m
SPEED ENDURANCE	80m	Glycolytic Short Speed End. (GSSE)	Anaerobic Glycolyte	90 - 95% 95 - 100%	1 / 3 min 1 / 4 min	300-800m 300-800m	600-1200m 600-1200m
SPEED ENDURANCE	0-150m	Speed Endurance (SE)	Anaerobic Glycolyte	90 - 95% 95 - 100%	5 - 6 min 6 - 10 min	300-900m 300-600m	400-1000m 400-800m
SPECIAL ENDURANCE I	150-300m	Long Speed Endurance (LSE)	Anaerobic Glycolyte	90 - 95% 95 - 100%	10 - 12 min 12 - 15 min	600-900m 300-900m	600-1200m 300-1000m
SPECIAL ENDURANCE II	300-600m	Lactic Tolerance (LAT)	Lactic Acid Tolerance	90 - 95% 95 - 100%	15 - 20 min Full	300-600m 300-600m	900-1200m 300-900m
INTENSIVE TEMPO	100-600m	Anaerobic Capacity (ANC)	Mixed: Aerobic Anaerobic	80 - 89%	30s - 5 / 3-10 min	800-1800m	1000-2800m
EXTENSIVE TEMPO	200-800m 100-200m	Aerobic Capacity (AC)	Aerobic Aerobic	40 - 79% 60 - 79%	45 - 2 min 30s / 2-3 min	1400-2500m 1400-1800m	2400-4000m 1800-3000m
CONTINUOUS TEMPO	1600-6400m	Aerobic (AC)	Aerobic	40 - 60%	Heart Rate 130-150	1600-3200m	3200-6400m

Practical Coaching Experience

- Develop speed and speed endurance concurrently
  - Intensity is not maximal but rather sub-maximal

Practical Coaching Experience

- Implement in Training Plan
  - Intensive Tempo runs (Lactacid Capacity) **before** Special Endurance (Lactacid Power) in the macrocycle
  - A system must have a capacity in order to express it's power
    - Intensive Tempo runs: 80-90% intensity, recoveries incomplete
    - Special Endurance runs: 95%+ intensity, recoveries complete.

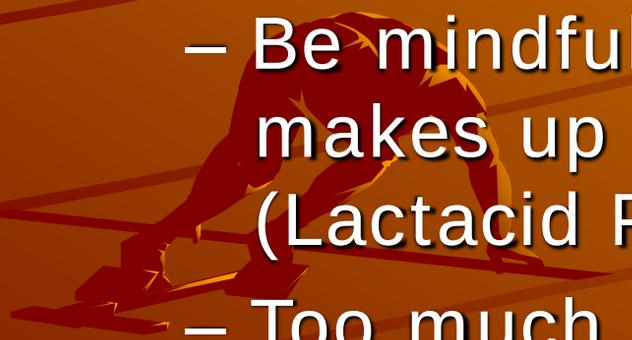


Practical Coaching Experience

- Maintain Intensive Tempo work (Lactacid Capacity) throughout the macrocycle
  - Aids in controlling the peaking process
  - Important to aid in the **continued** improvement of Special Endurance (Lactacid power) through the course of the year.

Practical Coaching Experience

- Use Special Endurance (Lactacid Power) work to prepare the athlete for competition.
  - Usually work in this area peaks in the late Special Preparation period.
  - Be mindful in the competitive period, competition makes up all or part of the Special Endurance (Lactacid Power) work.
  - Too much volume of this training will lead to “over-training.”



Speed Endurance Through the Year

Training priorities follow a basic yet simple principle.

- Use drills and exercises designed to call into play the same muscles and forces to be used in the actual event.
- Exercises involving hurdles of reduced height and spacing
- Speeds to be used which are at **least** 90% of race speed.

For over 20 years Dr. Ralph Mann has been collecting data on hurdle races

- Takeoff distance
  - Non-fatigued state:
    - Women: 2.04-2.05m
    - Men: 2.25-2.30m
  - Fatigued state:
    - Women: 1.75-1.80m
    - Men: 1.97-2.12m

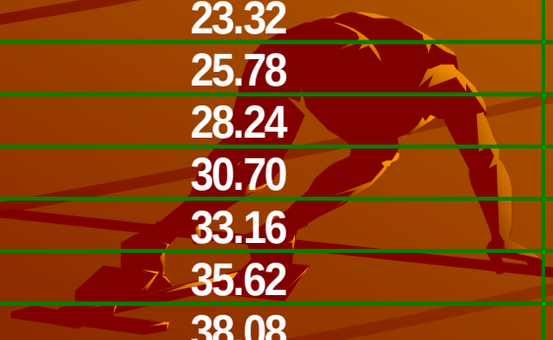
- Touchdown distance
  - Non-fatigued state:
    - Women: 1.10m
    - Men: 1.22-1.32m
  - Fatigued state:
    - Women: .95-1.00m
    - Men: 1.05-1.15m
- Hurdle Stride Length
  - Non-fatigued state:
    - Women: 3.15m
    - Men: 3.50-3.70m
  - Fatigued state:
    - Women: 2.75m
    - Men: 3.00-3.20m

General Preparation

- Intensive Tempo (Lactacid Capacity)
  - Hill running
  - 80% intensity runs
    - Sets of 4-6 runs with recoveries of 3-6’
    - Breakdowns: e.g. 500, 400, 300, 200, 100
      - Constant recoveries, constant pace
      - Decreasing recoveries, constant pace
      - Constant recoveries, increasing intensity
  - Density of application: 1-2 times in 7 days

400 Hurdles Stride Patterns

21 Strides	22 Strides	23 Strides	24 Strides
0.60	0.60	0.60	0.60
1.70	1.70	1.70	1.70
3.05	3.05	3.05	3.05
4.55	4.55	4.45	4.45
6.20	6.20	5.95	5.95
8.00	8.00	7.60	7.60
9.90	9.90	9.35	9.35
11.90	11.90	11.20	11.20
13.95	13.90	13.15	13.15
16.05	15.95	15.20	15.14
18.40	18.00	17.34	17.13
20.86	20.10	19.48	19.12
23.32	22.39	21.62	21.11
25.78	24.68	23.76	23.10
28.24	26.97	25.90	25.09
30.70	29.26	28.04	27.08
33.16	31.55	30.18	29.07
35.62	33.84	32.32	31.06
38.08	36.13	34.46	33.04
40.54	38.42	36.60	35.05
43.00	40.71	38.74	37.03
Hurdle 1	43.00	40.88	39.02
2.46 = 13 Stride Pattern	Hurdle 1	43.00	41.01
	2.29 = 14 Stride Pattern	Hurdle 1	43.00
		2.13 = 15 Stride Pattern	Hurdle 1
			2.00 = 16 Stride Pattern




COMPLEX


2.14 m


2.30 m


EXIT


EXIT


2.00 m


SACRAMENTO, CALIFORNIA


SPORTS COMPLEX


SACRAMENTO, CALIFORNIA
GIL SPANOS SPORTS COMPLEX

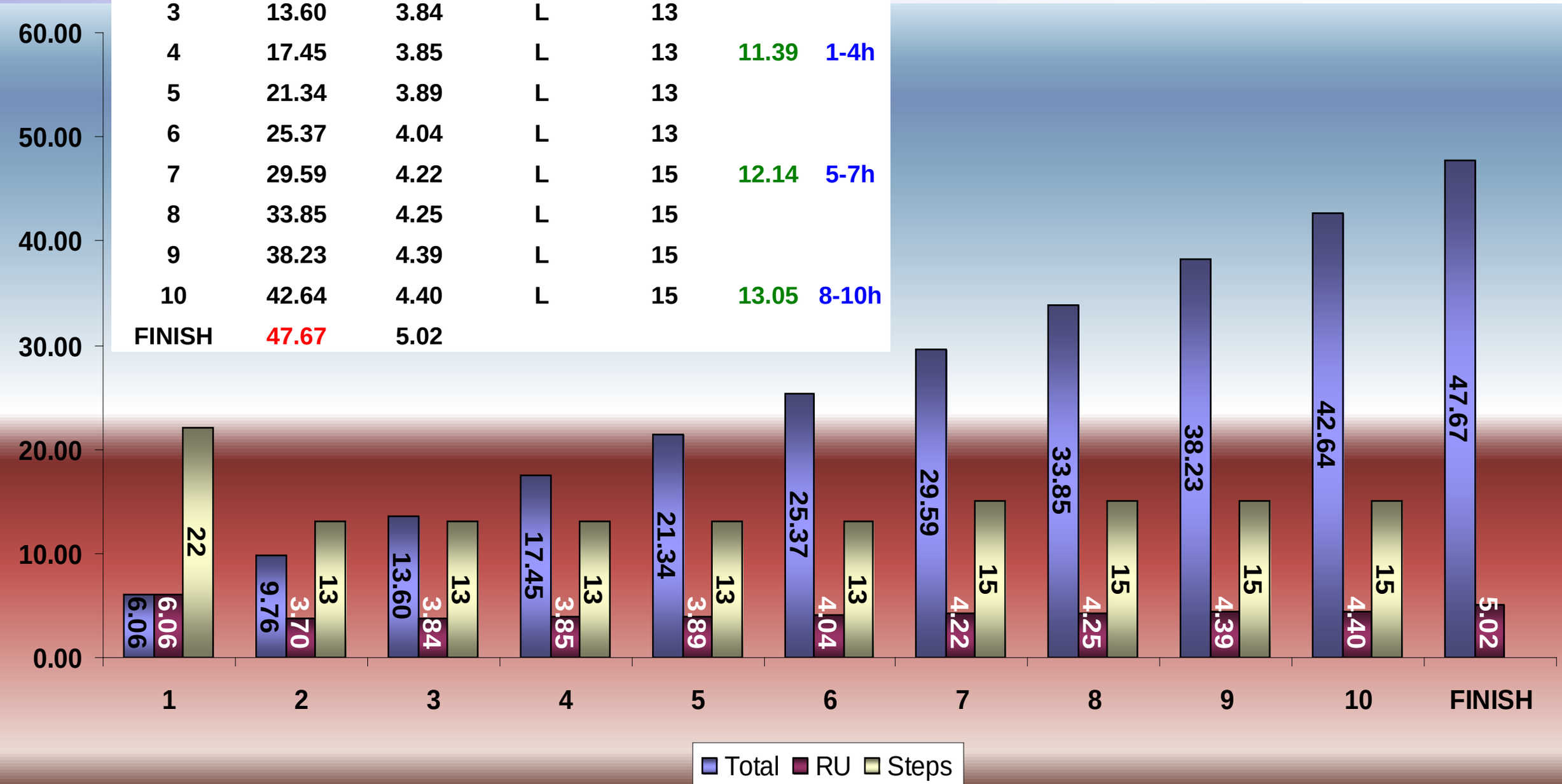

2.06 m


SACRAMENTO, CALIFORNIA
ALEX G. SPANOS SPORTS COMPLEX

Bennie Brazell

Bennie Brazell

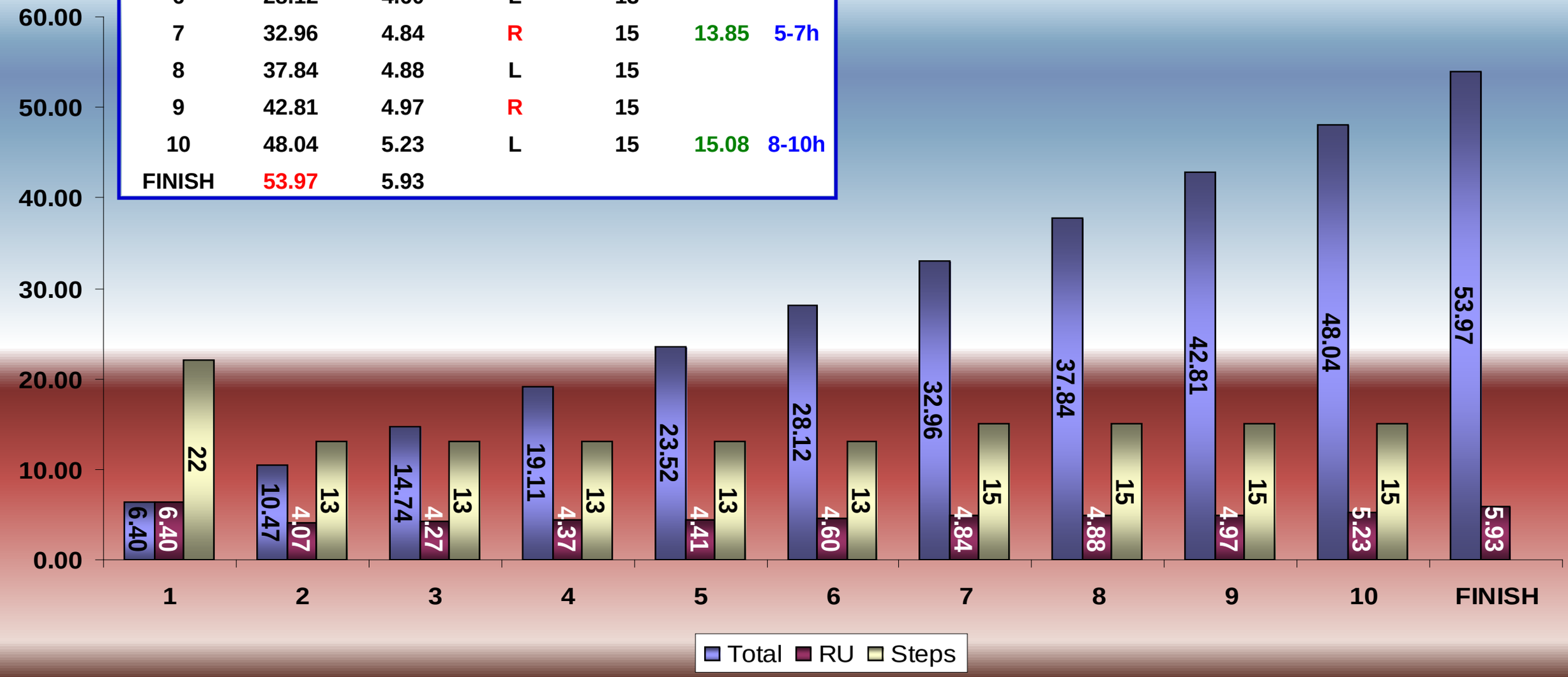
Hurdle	Total	RU	Lead	Steps		
1	6.06	6.06	L	22		
2	9.76	3.70	L	13		
3	13.60	3.84	L	13		
4	17.45	3.85	L	13	11.39	1-4h
5	21.34	3.89	L	13		
6	25.37	4.04	L	13		
7	29.59	4.22	L	15	12.14	5-7h
8	33.85	4.25	L	15		
9	38.23	4.39	L	15		
10	42.64	4.40	L	15	13.05	8-10h
FINISH	47.67	5.02				



Nickeisha Wilson

Nickiesha Wilson

Hurdle	Total	RU	Lead	Steps		
1	6.40	6.40	L	22		
2	10.47	4.07	L	13		
3	14.74	4.27	L	13		
4	19.11	4.37	L	13	12.71	1-4h
5	23.52	4.41	L	13		
6	28.12	4.60	L	13		
7	32.96	4.84	R	15	13.85	5-7h
8	37.84	4.88	L	15		
9	42.81	4.97	R	15		
10	48.04	5.23	L	15	15.08	8-10h
FINISH	53.97	5.93				



400mH

Steps =	9	10	11	12	13	14	15	16	17
%	of normal spacing								
100	13	25.15	27.62	30.08	32.54	35.00			
	14	23.57	25.86	28.14	30.43	32.71	35.00		
	15	22.20	24.33	26.47	28.60	30.73	32.87	35.00	
	16	21.00	23.00	25.00	27.00	29.00	31.00	33.00	35.00
	17	19.94	21.82	23.71	25.59	27.47	29.35	31.24	33.12	35.00

400mH

Steps =	9	10	11	12	13	14	15	16	17
%	of normal spacing								
98	13	24.65	27.06	29.48	31.89	34.30			
	14	23.10	25.34	27.58	29.82	32.06	34.30		
	15	21.76	23.85	25.94	28.03	30.12	32.21	34.30	
	16	20.58	22.54	24.50	26.46	28.42	30.38	32.34	34.30
	17	19.54	21.39	23.23	25.08	26.92	28.77	30.61	32.46	34.30

400mH

%	Steps =	9	10	11	12	13	14	15	16	17
	of normal spacing									
97	13	24.40	26.79	29.17	31.56	33.95				
	14	22.86	25.08	27.30	29.52	31.73	33.95			
	15	21.53	23.60	25.67	27.74	29.81	31.88	33.95		
	16	20.37	22.31	24.25	26.19	28.13	30.07	32.01	33.95	
	17	19.34	21.17	22.99	24.82	26.65	28.47	30.30	32.12	33.95

400mH

%	Steps =	9	10	11	12	13	14	15	16	17
	of normal spacing									
96	13	24.15	26.51	28.87	31.24	33.60				
	14	22.63	24.82	27.02	29.21	31.41	33.60			
	15	21.31	23.36	25.41	27.46	29.50	31.55	33.60		
	16	20.16	22.08	24.00	25.92	27.84	29.76	31.68	33.60	
	17	19.14	20.95	22.76	24.56	26.37	28.18	29.99	31.79	33.60

400mH

	Steps =	9	10	11	12	13	14	15	16	17
%	of normal spacing									
95	13	23.90	26.23	28.57	30.91	33.25				
	14	22.39	24.56	26.74	28.91	31.08	33.25			
	15	21.09	23.12	25.14	27.17	29.20	31.22	33.25		
	16	19.95	21.85	23.75	25.65	27.55	29.45	31.35	33.25	
	17	18.94	20.73	22.52	24.31	26.10	27.89	29.67	31.46	33.25

400mH

	Steps =	9	10	11	12	13	14	15	16	17
%	of normal spacing									
94	13	23.64	25.96	28.27	30.59	32.90				
	14	22.16	24.31	26.45	28.60	30.75	32.90			
	15	20.87	22.87	24.88	26.88	28.89	30.89	32.90		
	16	19.74	21.62	23.50	25.38	27.26	29.14	31.02	32.90	
	17	18.74	20.51	22.28	24.05	25.82	27.59	29.36	31.13	32.90

400mH

%	Steps =	9	10	11	12	13	14	15	16	17
	of normal spacing									
93	13	23.39	25.68	27.97	30.26	32.55				
	14	21.92	24.05	26.17	28.30	30.42	32.55			
	15	20.65	22.63	24.61	26.60	28.58	30.57	32.55		
	16	19.53	21.39	23.25	25.11	26.97	28.83	30.69	32.55	
	17	18.55	20.30	22.05	23.80	25.55	27.30	29.05	30.80	32.55

400mH

%	Steps =	9	10	11	12	13	14	15	16	17
	of normal spacing									
90	13	22.64	24.85	27.07	29.28	31.50				
	14	21.21	23.27	25.33	27.39	29.44	31.50			
	15	19.98	21.90	23.82	25.74	27.66	29.58	31.50		
	16	18.90	20.70	22.50	24.30	26.10	27.90	29.70	31.50	
	17	17.95	19.64	21.34	23.03	24.72	26.42	28.11	29.81	31.50

400mH

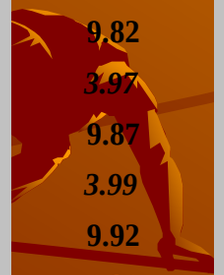
%	Steps =	9	10	11	12	13	14	15	16	17
	of normal spacing									
88	13	22.14	24.30	26.47	28.63	30.80				
	14	20.74	22.75	24.77	26.78	28.79	30.80			
	15	19.54	21.41	23.29	25.17	27.05	28.92	30.80		
	16	18.48	20.24	22.00	23.76	25.52	27.28	29.04	30.80	
	17	17.55	19.20	20.86	22.52	24.17	25.83	27.49	29.14	30.80

400mH

Steps =	9	10	11	12	13	14	15	16	17
%	of normal spacing								
86	13	21.63	23.75	25.87	27.98	30.10			
	14	20.27	22.24	24.20	26.17	28.13	30.10		
	15	19.09	20.93	22.76	24.60	26.43	28.27	30.10	
	16	18.06	19.78	21.50	23.22	24.94	26.66	28.38	30.10
	17	17.15	18.77	20.39	22.01	23.62	25.24	26.86	28.48	30.10

400 Meter Pace Chart

FINISH	H1	H2	H3	H4	H5	H6	H7	H8	H9	H10	FINISH
47.00	5.67	9.52	13.37	17.25	21.18	25.20	29.30	33.49	37.85	42.21	47.00
		3.85	3.85	3.89	3.93	4.02	4.10	4.19	4.36	4.36	4.79
47.25	5.70	9.57	13.44	17.35	21.30	25.33	29.46	33.67	38.05	42.43	47.25
		3.87	3.87	3.91	3.95	4.04	4.12	4.21	4.38	4.38	4.82
47.50	5.73	9.62	13.51	17.44	21.41	25.47	29.61	33.85	38.25	42.66	47.50
		3.89	3.89	3.93	3.97	4.06	4.15	4.23	4.40	4.40	4.85
47.75	5.76	9.67	13.58	17.53	21.52	25.60	29.77	34.02	38.45	42.88	47.75
		3.91	3.91	3.95	3.99	4.08	4.17	4.25	4.43	4.43	4.87
48.00	5.79	9.72	13.65	17.62	21.63	25.74	29.93	34.20	38.65	43.10	48.00
		3.93	3.93	3.97	4.01	4.10	4.19	4.28	4.45	4.45	4.90
48.25	5.83	9.77	13.72	17.71	21.75	25.87	30.08	34.38	38.85	43.33	48.25
		3.95	3.95	3.99	4.04	4.12	4.21	4.30	4.47	4.47	4.92
48.50	5.86	9.82	13.79	17.80	21.86	26.00	30.24	34.56	39.06	43.55	48.50
		3.97	3.97	4.01	4.06	4.14	4.23	4.32	4.50	4.50	4.95
48.75	5.89	9.87	13.86	17.90	21.97	26.14	30.39	34.74	39.26	43.78	48.75
		3.99	3.99	4.03	4.08	4.17	4.25	4.34	4.52	4.52	4.97
49.00	5.92	9.92	13.93	17.99	22.09	26.27	30.55	34.91	39.46	44.00	49.00
		4.01	4.01	4.05	4.10	4.19	4.28	4.37	4.54	4.54	5.00
49.25	5.95	9.98	14.00	18.08	22.20	26.41	30.71	35.09	39.66	44.23	49.25
		4.03	4.03	4.07	4.12	4.21	4.30	4.39	4.57	4.57	5.02
49.50	5.98	10.03	14.08	18.17	22.31	26.54	30.86	35.27	39.86	44.45	49.50
		4.05	4.05	4.09	4.14	4.23	4.32	4.41	4.59	4.59	5.05
49.75	6.01	10.08	14.15	18.26	22.42	26.68	31.02	35.45	40.06	44.68	49.75
		4.07	4.07	4.12	4.16	4.25	4.34	4.43	4.61	4.61	5.07
50.00	6.04	10.13	14.22	18.35	22.54	26.81	31.17	35.63	40.26	44.90	50.00
		4.09	4.09	4.14	4.18	4.27	4.36	4.45	4.64	4.64	5.10

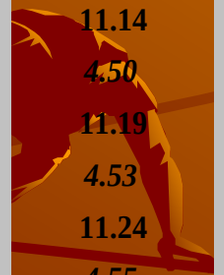


400 Meter Pace Chart

FINISH	H1	H2	H3	H4	H5	H6	H7	H8	H9	H10	FINISH
50.25	6.07	10.18	14.29	18.45	22.65	26.94	31.33	35.81	40.46	45.12	50.25
		4.11	4.11	4.16	4.20	4.29	4.39	4.48	4.66	4.66	5.13
50.50	6.10	10.23	14.36	18.54	22.76	27.08	31.48	35.98	40.67	45.35	50.50
		4.13	4.13	4.18	4.22	4.32	4.41	4.50	4.68	4.68	5.15
50.75	6.13	10.28	14.43	18.63	22.87	27.21	31.64	36.16	40.87	45.57	50.75
		4.15	4.15	4.20	4.24	4.34	4.43	4.52	4.71	4.71	5.18
51.00	6.16	10.33	14.50	18.72	22.99	27.35	31.80	36.34	41.07	45.80	51.00
		4.17	4.17	4.22	4.27	4.36	4.45	4.54	4.73	4.73	5.20
51.25	6.19	10.38	14.57	18.81	23.10	27.48	31.95	36.52	41.27	46.02	51.25
		4.19	4.19	4.24	4.29	4.38	4.47	4.57	4.75	4.75	5.23
51.50	6.22	10.43	14.64	18.91	23.21	27.61	32.11	36.70	41.47	46.25	51.50
		4.21	4.21	4.26	4.31	4.40	4.49	4.59	4.78	4.78	5.25
51.75	6.25	10.48	14.72	19.00	23.33	27.75	32.26	36.87	41.67	46.47	51.75
		4.23	4.23	4.28	4.33	4.42	4.52	4.61	4.80	4.80	5.28
52.00	6.34	10.54	14.74	19.04	23.34	27.74	32.24	36.94	41.64	46.54	52.00
		4.20	4.20	4.30	4.30	4.40	4.50	4.70	4.70	4.90	5.15
52.25	6.37	10.59	14.82	19.14	23.47	27.89	32.42	37.13	41.87	46.78	52.25
		4.23	4.23	4.33	4.33	4.43	4.53	4.71	4.74	4.91	5.47
52.50	6.39	10.64	14.89	19.24	23.59	28.04	32.59	37.32	42.09	47.02	52.50
		4.25	4.25	4.35	4.35	4.45	4.55	4.72	4.78	4.93	5.48
52.75	6.42	10.69	14.97	19.34	23.72	28.19	32.77	37.50	42.32	47.25	52.75
		4.28	4.28	4.38	4.38	4.48	4.58	4.74	4.81	4.94	5.50
53.00	6.44	10.74	15.04	19.44	23.84	28.34	32.94	37.69	42.54	47.49	53.00
		4.30	4.30	4.40	4.40	4.50	4.60	4.75	4.85	4.95	5.51
53.25	6.47	10.79	15.12	19.54	23.97	28.49	33.12	37.88	42.77	47.73	53.25
		4.33	4.33	4.43	4.43	4.53	4.62	4.76	4.89	4.96	5.52

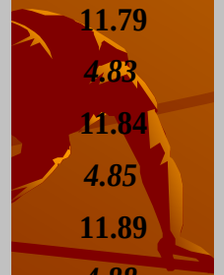
400 Meter Pace Chart

FINISH	H1	H2	H3	H4	H5	H6	H7	H8	H9	H10	FINISH
53.50	6.49	10.84	15.19	19.64	24.09	28.64	33.29	38.07	42.99	47.97	53.50
		4.35	*4.35*	*4.45*	*4.45*	*4.55*	*4.65*	*4.78*	*4.93*	*4.98*	5.53
53.75	6.52	10.89	15.27	19.74	24.22	28.79	33.47	38.25	43.22	48.20	53.75
		4.38	*4.38*	*4.48*	*4.48*	*4.58*	*4.68*	*4.79*	*4.96*	*4.99*	5.55
54.00	6.54	10.94	15.34	19.84	24.34	28.94	33.64	38.44	43.44	48.44	54.00
		4.40	*4.40*	*4.50*	*4.50*	*4.60*	*4.70*	*4.80*	*5.00*	*5.00*	5.56
54.25	6.57	10.99	15.42	19.93	24.45	29.08	33.80	38.63	43.65	48.68	54.25
		4.43	*4.43*	*4.51*	*4.53*	*4.63*	*4.73*	*4.83*	*5.03*	*5.03*	5.57
54.50	6.59	11.04	15.49	20.02	24.57	29.22	33.97	38.82	43.87	48.92	54.50
		4.45	*4.45*	*4.53*	*4.55*	*4.65*	*4.75*	*4.85*	*5.05*	*5.05*	5.58
54.75	6.62	11.09	15.57	20.10	24.68	29.35	34.13	39.00	44.08	49.15	54.75
		4.48	*4.48*	*4.54*	*4.58*	*4.68*	*4.78*	*4.88*	*5.08*	*5.08*	5.60
55.00	6.64	11.14	15.64	20.19	24.79	29.49	34.29	39.19	44.29	49.39	55.00
		4.50	*4.50*	*4.55*	*4.60*	*4.70*	*4.80*	*4.90*	*5.10*	*5.10*	5.61
55.25	6.67	11.19	15.72	20.28	24.90	29.63	34.45	39.38	44.50	49.63	55.25
		4.53	*4.53*	*4.56*	*4.63*	*4.73*	*4.83*	*4.93*	*5.13*	*5.13*	5.62
55.50	6.69	11.24	15.79	20.37	25.02	29.77	34.62	39.57	44.72	49.87	55.50
		4.55	*4.55*	*4.58*	*4.65*	*4.75*	*4.85*	*4.95*	*5.15*	*5.15*	5.63
55.75	6.72	11.29	15.87	20.45	25.13	29.90	34.78	39.75	44.93	50.10	55.75
		4.58	*4.58*	*4.59*	*4.68*	*4.78*	*4.88*	*4.98*	*5.18*	*5.18*	5.65
56.00	6.74	11.34	15.94	20.54	25.24	30.04	34.94	39.94	45.14	50.34	56.00
		4.60	*4.60*	*4.60*	*4.70*	*4.80*	*4.90*	*5.00*	*5.20*	*5.20*	5.66
56.25	6.77	11.39	16.02	20.64	25.35	30.17	35.25	40.29	45.52	50.75	56.25
		4.63	*4.63*	*4.63*	*4.71*	*4.81*	*5.09*	*5.04*	*5.23*	*5.24*	5.50
56.50	6.79	11.44	16.09	20.74	25.47	30.29	35.57	40.64	45.89	51.17	56.50
		4.65	*4.65*	*4.65*	*4.73*	*4.83*	*5.28*	*5.08*	*5.25*	*5.28*	5.33



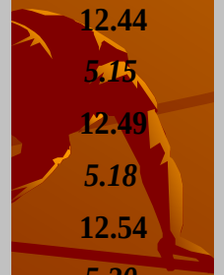
400 Meter Pace Chart

FINISH	H1	H2	H3	H4	H5	H6	H7	H8	H9	H10	FINISH
56.75	6.82	11.49	16.17	20.84	25.58	30.42	35.88	40.99	46.27	51.58	56.75
		4.68	*4.68*	*4.68*	*4.74*	*4.84*	*5.46*	*5.11*	*5.28*	*5.31*	5.17
57.00	6.84	11.54	16.24	20.94	25.69	30.54	36.19	41.34	46.64	51.99	57.00
		4.70	*4.70*	*4.70*	*4.75*	*4.85*	*5.65*	*5.15*	*5.30*	*5.35*	5.01
57.25	6.87	11.59	16.32	21.04	25.80	30.67	36.50	41.69	47.02	52.40	57.25
		4.73	*4.73*	*4.73*	*4.76*	*4.86*	*5.84*	*5.19*	*5.33*	*5.39*	4.85
57.50	6.89	11.64	16.39	21.14	25.92	30.79	36.82	42.04	47.39	52.82	57.50
		4.75	*4.75*	*4.75*	*4.78*	*4.88*	*6.03*	*5.23*	*5.35*	*5.43*	4.68
57.75	6.92	11.69	16.47	21.24	26.03	30.92	37.13	42.39	47.77	53.23	57.75
		4.78	*4.78*	*4.78*	*4.79*	*4.89*	*6.21*	*5.26*	*5.38*	*5.46*	4.52
58.00	6.94	11.74	16.54	21.34	26.14	31.04	37.44	42.74	48.14	53.64	58.00
		4.80	*4.80*	*4.80*	*4.80*	*4.90*	*6.40*	*5.30*	*5.40*	*5.50*	4.36
58.25	6.97	11.79	16.62	21.44	26.27	31.19	37.44	42.74	48.02	53.64	58.25
		4.83	*4.83*	*4.83*	*4.83*	*4.93*	*6.25*	*5.30*	*5.28*	*5.63*	4.61
58.50	6.99	11.84	16.69	21.54	26.39	31.34	37.44	42.74	47.89	53.64	58.50
		4.85	*4.85*	*4.85*	*4.85*	*4.95*	*6.10*	*5.30*	*5.15*	*5.75*	4.86
58.75	7.02	11.89	16.77	21.64	26.52	31.49	37.44	42.74	47.77	53.64	58.75
		4.88	*4.88*	*4.88*	*4.88*	*4.98*	*5.95*	*5.30*	*5.03*	*5.88*	5.11
59.00	7.04	11.94	16.84	21.74	26.64	31.64	37.44	42.74	47.64	53.64	59.00
		4.90	*4.90*	*4.90*	*4.90*	*5.00*	*5.80*	*5.30*	*4.90*	*6.00*	5.36
59.25	7.07	11.99	16.92	21.84	26.77	31.79	37.44	42.74	47.52	53.64	59.25
		4.93	*4.93*	*4.93*	*4.93*	*5.03*	*5.65*	*5.30*	*4.78*	*6.13*	5.61
59.50	7.09	12.04	16.99	21.94	26.89	31.94	37.44	42.74	47.39	53.64	59.50
		4.95	*4.95*	*4.95*	*4.95*	*5.05*	*5.50*	*5.30*	*4.65*	*6.25*	5.86
59.75	7.12	12.09	17.07	22.04	27.02	32.09	37.44	42.74	47.27	53.64	59.75
		4.98	*4.98*	*4.98*	*4.98*	*5.08*	*5.35*	*5.30*	*4.53*	*6.38*	6.11



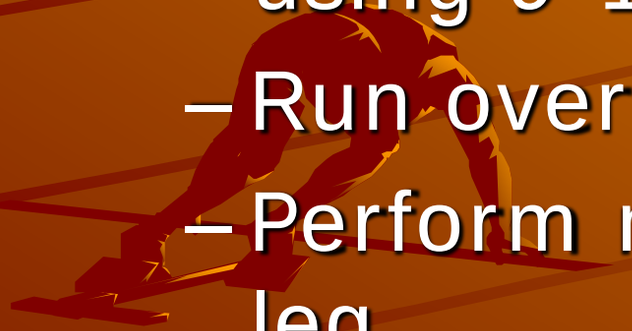
400 Meter Pace Chart

FINISH	H1	H2	H3	H4	H5	H6	H7	H8	H9	H10	FINISH
60.00	7.14	12.14	17.14	22.14	27.14	32.24	37.44	42.74	47.14	53.64	60.00
		5.00	*5.00*	*5.00*	*5.00*	*5.10*	*5.20*	*5.30*	*4.40*	*6.50*	6.36
60.25	7.17	12.19	17.22	22.23	27.25	32.38	37.59	42.92	47.47	53.87	60.25
		5.03	*5.03*	*5.01*	*5.03*	*5.13*	*5.21*	*5.33*	*4.55*	*6.40*	6.38
60.50	7.19	12.24	17.29	22.32	27.37	32.52	37.74	43.09	47.79	54.09	60.50
		5.05	*5.05*	*5.03*	*5.05*	*5.15*	*5.22*	*5.35*	*4.70*	*6.30*	6.41
60.75	7.22	12.29	17.37	22.40	27.48	32.65	37.89	43.27	48.12	54.32	60.75
		5.08	*5.08*	*5.04*	*5.08*	*5.18*	*5.24*	*5.38*	*4.85*	*6.20*	6.43
61.00	7.24	12.34	17.44	22.49	27.59	32.79	38.04	43.44	48.44	54.54	61.00
		5.10	*5.10*	*5.05*	*5.10*	*5.20*	*5.25*	*5.40*	*5.00*	*6.10*	6.46
61.25	7.27	12.39	17.52	22.58	27.70	32.93	38.19	43.62	48.77	54.77	61.25
		5.13	*5.13*	*5.06*	*5.13*	*5.23*	*5.26*	*5.43*	*5.15*	*6.00*	6.48
61.50	7.29	12.44	17.59	22.67	27.82	33.07	38.34	43.79	49.09	54.99	61.50
		5.15	*5.15*	*5.08*	*5.15*	*5.25*	*5.28*	*5.45*	*5.30*	*5.90*	6.51
61.75	7.32	12.49	17.67	22.75	27.93	33.20	38.49	43.97	49.42	55.22	61.75
		5.18	*5.18*	*5.09*	*5.18*	*5.28*	*5.29*	*5.48*	*5.45*	*5.80*	6.53
62.00	7.34	12.54	17.74	22.84	28.04	33.34	38.64	44.14	49.74	55.44	62.00
		5.20	*5.20*	*5.10*	*5.20*	*5.30*	*5.30*	*5.50*	*5.60*	*5.70*	6.56
62.25	7.37	12.58	17.79	22.93	28.15	33.48	38.82	44.33	49.94	55.67	62.25
		5.21	*5.21*	*5.14*	*5.23*	*5.33*	*5.34*	*5.51*	*5.61*	*5.73*	6.58
62.50	7.39	12.62	17.84	23.02	28.27	33.62	38.99	44.52	50.14	55.89	62.50
		5.23	*5.23*	*5.18*	*5.25*	*5.35*	*5.38*	*5.53*	*5.63*	*5.75*	6.61
62.75	7.42	12.65	17.89	23.10	28.38	33.75	39.17	44.70	50.34	56.12	62.75
		5.24	*5.24*	*5.21*	*5.28*	*5.38*	*5.41*	*5.54*	*5.64*	*5.78*	6.63
63.00	7.44	12.69	17.94	23.19	28.49	33.89	39.34	44.89	50.54	56.34	63.00
		5.25	*5.25*	*5.25*	*5.30*	*5.40*	*5.45*	*5.55*	*5.65*	*5.80*	6.66



Long Hurdle Drill

- Optimal Hurdle Runs
  - Space hurdles at 19-22m
  - Utilize spacing to allow for smooth transitions using 9-11 strides between
  - Run over 4-5 hurdles
  - Perform more runs using non-preferred lead leg



Stride Management

- Via lane position
  - Full turn gives you approximately **3** full meters, depending on the position you run in the lane

USE IT

Special Preparation

- Intensive Tempo (Lactacid Capacity)
  - 85-90% intensity runs
    - Sets of 3-4 runs with recoveries of 5-6’
    - Breakdowns: e.g. 500, 400, 300, 200, 100
  - Density of application: 1 time in 7 days
- Short Speed Endurance
  - Utilize to bridge between Capacity and Power maintaining technical integrity
- Special Endurance (Lactacid Power)
  - Middle to late in period
  - Progress from 1-2 runs to 3-4 runs per session
  - Density of application: 1 time in 7-10 days

Competition Period

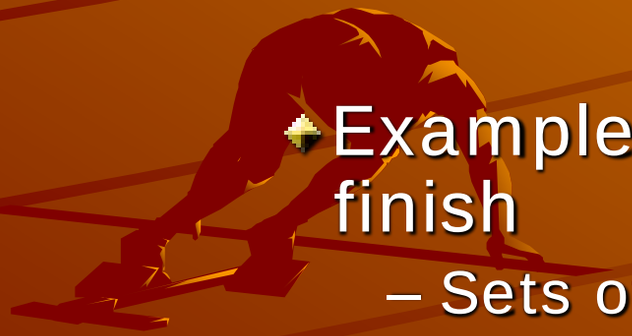
- Intensive Tempo (Lactacid Capacity)
  - 85-90% intensity runs
    - Sets of 3-4 runs with recoveries of 5-6’
  - Density of application: 1 time in 7 days
- Special Endurance (Lactacid Power)
  - Progress from 1-2 runs to 3-4 runs per session
  - Density of application: 1 time in 7-10 days depending on density of competition

Examples of Speed Endurance for the Long Hurdles

- Intensive Tempo runs over 400m Hurdles from blocks (Lactacid Capacity)
  - Competition Spacing
    - 4-8 hurdles
    - Recoveries of 3-5’
  - Reduced spacing (60-90cm reduction)
    - 6-10 hurdles
    - Recoveries of 4-6’

Examples of Speed Endurance for the Long Hurdles

- Runs over 400m Hurdles from standing start for Speed Endurance (Alactacid Power) and Intensive Tempo (Lactacid Capacity)
  - Competition Spacing
    - 4 hurdles repeated
    - Recoveries of jog back within set and 10’ between sets



    - Example: Run hurdles 5-6-7-8 with 25m start and 25m finish
      - Sets of 3-5 runs
      - Set stops when sum of rhythmic units falls below competition goal

Examples of Speed Endurance for the Long Hurdles

- Runs over 400m Hurdles from blocks for Special Endurance (Lactacid Power)
  - Competition Spacing
    - 4-8 hurdles
    - Full Recoveries
  - Reduced spacing (60-90cm)
    - 6-10 hurdles
    - Full Recoveries

In Closing

SAFE AND HAPPY HOLLIDAY