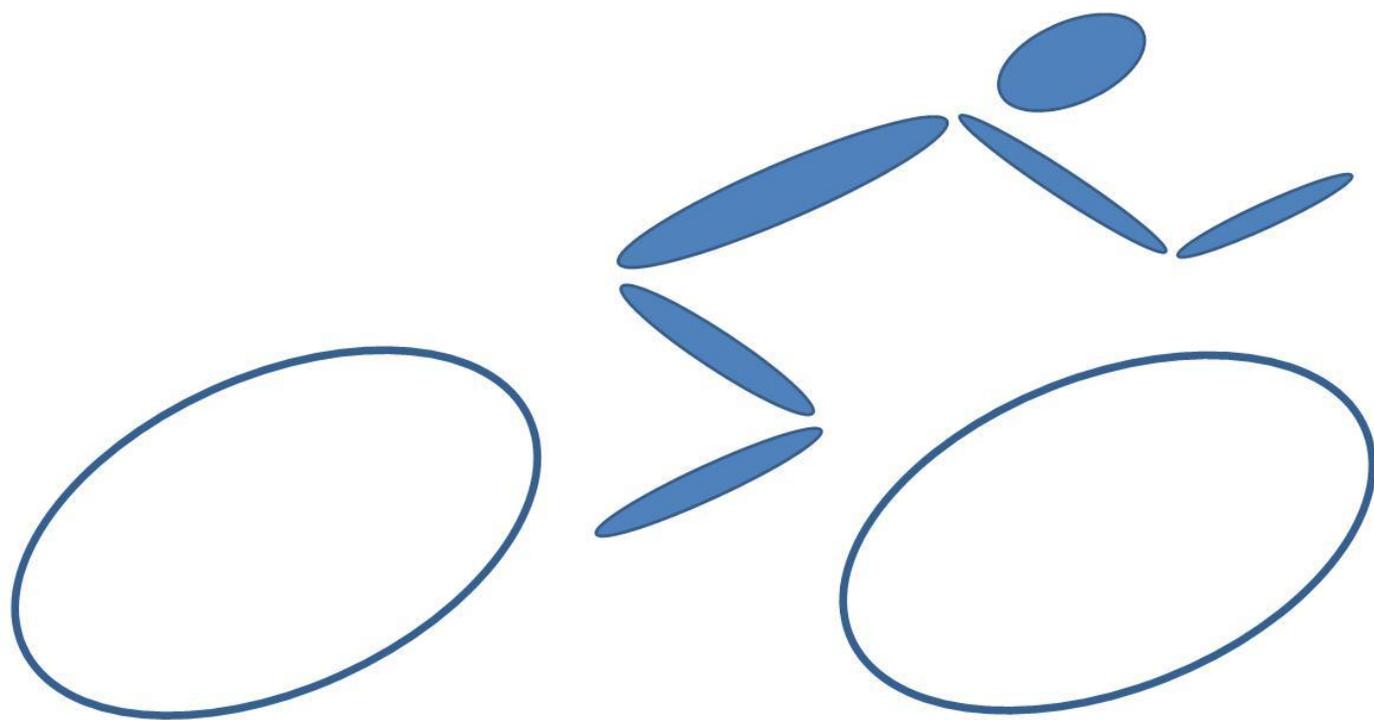


# Basics of Cycling Training



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## **Disclaimer**

This e-book is intended to inform the reader of the basics of a cycling fitness program. Training methods outlined herein should not be adopted without consultation with your health professional. Use of this information herein is at the sole choice and risk of the reader. The author is neither responsible for, nor liable for any harm or injury resulting from, the use of the information described herein.

## **About the Author**

Coach David Ertl has been riding and racing bikes practically all his life. He began riding at age 5, began competing in 1973, and he continues to compete as a Master's athlete to this day. David became a certified coach with USA Cycling in 2002. In 2004 he became a Certified Personal Trainer with the National Strength and Conditioning Association (NSCA) and in 2007 obtained the highest coaching level offered by USA Cycling, Level 1. David coaches individual cyclists as well as two teams, the Des Moines Cycle Club Race Team and the Iowa Chapter of the JDRF Ride to Cure Diabetes Team. In addition to personal coaching, David also provides online training plans and information, including 15 week and annual training plans for recreational and competitive cyclists and triathletes. Learn more about his background and coaching programs at [www.CyclesportCoaching.com](http://www.CyclesportCoaching.com).

He has written three book : '101 Cycling Workouts', 'Training For Busy Cyclists', and 'Indoor Training for Cyclists', which are available online at [www.CyclesportCoaching.com](http://www.CyclesportCoaching.com).

He and his wife, Angie, own the 24/7 X-Press Fitness Center and Pilates Studio in Des Moines, Iowa. He and his family ride and reside in Waukee, Iowa.

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## Forward

This e-booklet is a short but concise summary of the basic ideas behind the creation of a structured, periodized cycling training plan. It discusses the capabilities and physiological systems required by road cyclists to perform in all aspects of the sport, and gives a sampling of workouts and what they are intended to improve. There's a lot more to it than just 'riding your bike'. This e-book will help you understand the theory behind a structured training plan, to either help you design one on your own, or if you work with a coach to help you better understand what the coach is trying to accomplish and how.

If you are interested in learning more about how to train efficiently and effectively, check out the pre-built training plans, eBooks, and other resources available at [www.CyclesportCoaching.com](http://www.CyclesportCoaching.com).

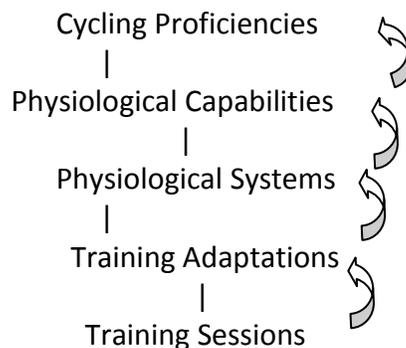
**Please feel free to pass this eBook along to your cycling friends.**

Don't just ride your bike, Train! -- David Ertl

# Basics of Cycling Training

Bicycle racing demands a wide range of physiological capabilities, from being able to ride at race pace for hours and then finish with a sprint at full speed, to be able to climb long and short hills, to accelerating anaerobically several times per mile in a criterium. Unlike cycling, many endurance sports do not require the extremes in physiological capabilities (e.g. marathoners don't need a fast sprint). Because cycling requires such a wide range of capabilities, it is a challenge to develop a training plan that prepares a cyclist for all aspects adequately.

Cyclists ultimately need well developed **Cycling Proficiencies**. These are supported by **Physiological Capabilities**, which in turn are supported by **Physiological Systems**. To improve these physiological systems requires developing **Training Adaptations** which in turn determine the type of **Training Sessions** required.



## A. Cycling Proficiencies

Let's start by looking at the required **cycling proficiencies** required by an all-around road cyclist. Those discussed here include only the physiological proficiencies, not skills, tactics, or mental proficiencies, which are also required for success. The main ones include:

- Sprinting
- Climbing (long mountains and short hills)
- Time trialing
- Attacking/chasing breaks/accelerations
- Multi-hour road racing

## **B. Physiological Capabilities**

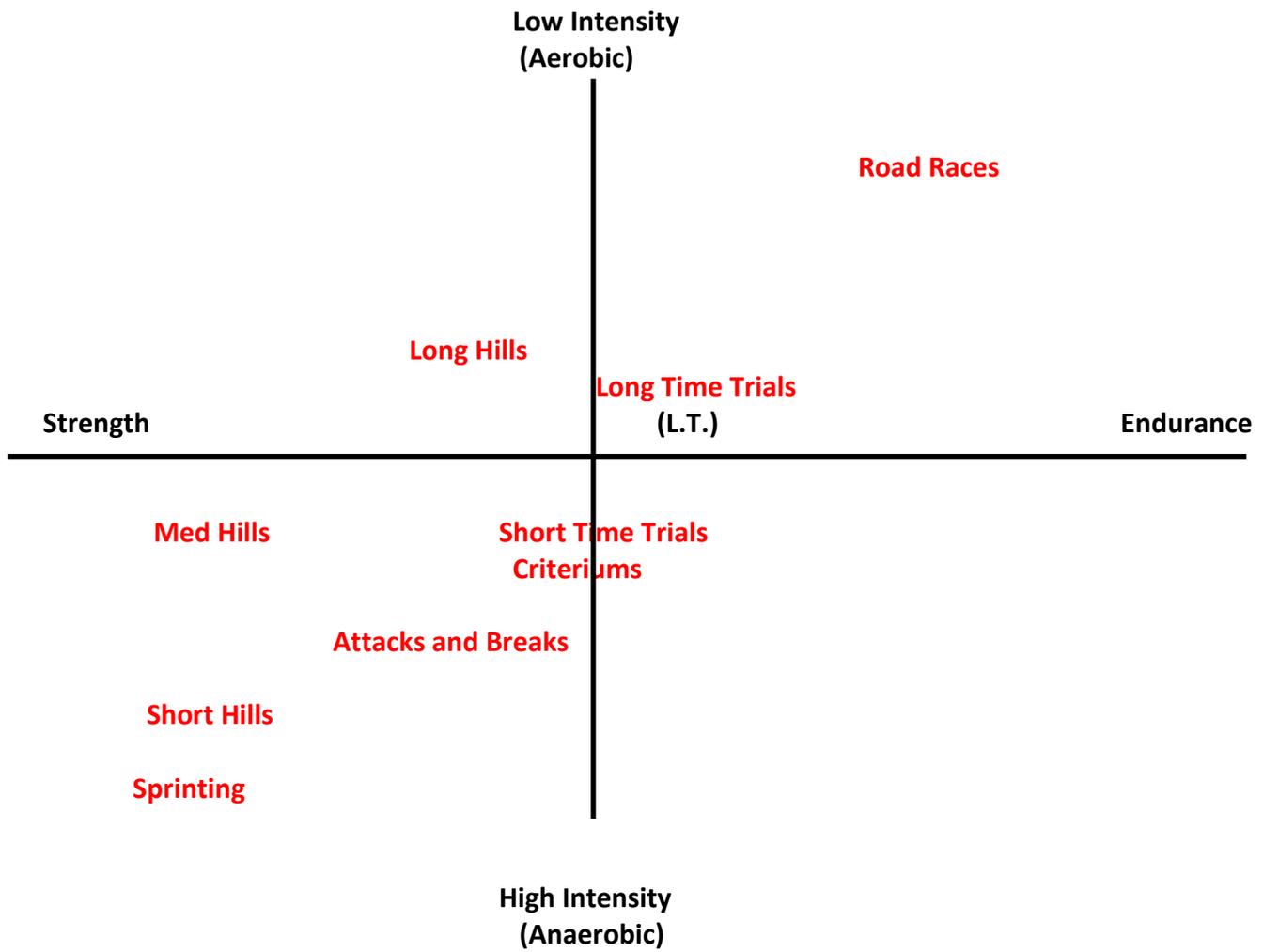
To support these cycling proficiencies, there are several **physiological capabilities** that are called upon to provide the required output. These can be categorized in three general ways. Every form of cycling is some combination of **strength, endurance**, and level of **intensity**. Intensity level is described and measured in several ways (% of maximum heart rate; % of V02 max; heart rate zones 1-5; % of Lactate Threshold; watts; relative perceived exertion (RPE) values 1-20).

### **CYCLING = STRENGTH x ENDURANCE x INTENSITY**

The combination of these three capabilities is different for each of the cycling proficiencies. Time trialing is a rather equal combination of strength, endurance, and level of intensity. Sprinting requires maximum intensity and strength but no endurance. Chasing down a break requires a fairly high intensity level (anaerobic) with limited endurance.

The following diagram shows how these cycling proficiencies fit into the three major physiological capabilities. Each of these types of cycling types requires a different combination of the three physiologies. Note that there is not a type of cycling that requires high strength at an aerobic pace (upper left), just as there are no types that require high endurance and anaerobic conditions (lower right). These pairs of capabilities don't go together.

Understanding this chart will allow you to think about the three sets of physiological capabilities you need to develop.



## **C. Physiological Systems**

Behind the physiological capabilities are **physiological systems** that explain the basis for being able to perform cycling activities as well as explain how exercise improves the physiological capabilities. To perform in cycling, the body has three major physiological systems to support the exercise. These are the **Cardiovascular**, **Energy** and **Muscular** systems.

### **Types of physiological systems:**

- I. Energy Systems
- II. Cardiovascular System
- III. Muscular System

### **I. Types of Energy Systems:**

- Creatine-Phosphate (10-15 second efforts)
- Anaerobic (30 seconds to two minutes)
- Aerobic (long efforts 4 min to hours)

### **II. Cardiovascular System:**

Maximum Heart Rate (MHR) is the highest rate your heart is capable of beating under the maximum exertion.

Lactate Threshold (LT) or Anaerobic Threshold (AT) is the heart rate at which you begin to accumulate lactic acid in your muscles – where anaerobic energy production surpasses aerobic. It is the rate at which the effort is no longer sustainable for long periods of time. This generally occurs at 85-92% of MHR. Various cycling coaches use different zones. I use six and they are listed below, and are based on percentage of your anaerobic or lactate threshold.

#### **Heart Rate Zones:**

**Zone 1** = Recovery (<71% of AT) – uses the aerobic system

**Zone 2** = Endurance (72-81% of AT) – uses the aerobic system

**Zone 3** = Tempo Pace (82-91% of AT) – uses mainly aerobic system

**Zone 4** = Threshold Pace ( 92-102% of AT) – uses mainly aerobic system with some anaerobic system

**Zone 5** = Anaerobic Pace (103-110% of AT) – covers zone where aerobic converts to the anaerobic system.

**Zone 6** = Maximum aerobic capacity (Too short to record HR) – anaerobic and CP systems

Your cardiovascular output can also be measured with power if you use a power meter on your bike. Similar to heart rate, there are also power zones. My six zones are shown here for power, and are based on those of Hunter Allen and Andrew Coggan.

#### **Power Zones:**

- Zone 1** = Recovery (<55% of TP) – uses the aerobic system
- Zone 2** = Endurance (56-75% of TP) – uses the aerobic system
- Zone 3** = Tempo Pace (76-90% of TP) – uses mainly aerobic system
- Zone 4** = Threshold Pace (91-105% of TP) – uses mainly aerobic system with some anaerobic system
- Zone 5** = Anaerobic Pace (106-120% of TP) – covers zone where aerobic converts to the anaerobic system.
- Zone 6** = Maximum capacity (VO2 Max) (>120% of TP) – anaerobic and CP systems

#### **How to estimate your AT or TP:**

AT and TP is the maximum sustainable pace you can maintain during a time trial effort that lasts about an hour. However, it's possible to estimate this heart rate or power from a shorter 20 min time trial effort. Find a road that is relatively level and free of traffic and intersections. You may need to find a road that's about 5 miles and do an 'out and back' course to get your 20 min test done. Alternately, you can do this on an indoor trainer. In some ways this gives you a more repeatable result as you don't have the weather and traffic variables. Warm up thoroughly, then begin the 20 minute time trial. Ride as hard as you can at a pace you can maintain for the full 20 minutes. There is a fine line between going out too fast and not pushing yourself hard enough. You may need to do a few of these before you figure out your sustainable pace. Record your heart rate and/or power toward the end of the 20 min. Do not accelerate or sprint at the end. What we are after is your sustainable heart rate or power. If you have a computer that allows you, take the average heart rate or power for the last 5 minutes of the effort.

The pace you can maintain for 20 min is slightly faster than the pace you can maintain for an hour. So take your heart rate or power from this 20 minute test and multiply by 0.95 to arrive at your sustainable pace, which is your estimated Anaerobic Threshold (AT) or Threshold Power (PT). Use this value to estimate your own zones as described above or using the table below.

These power threshold zones and method for determining them are based on those advocated by Allen and Coggan in their book, 'Training and Racing with a Power Meter'.

Use this chart below to identify your zones based on your own AT and TP values obtained from your test:

**Heart Rate Training Zones**

	Recovery	Endurance	Tempo	Threshold	Anaerobic	Max Effort
A.T. Heart Rate (Beat/Min)	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6
130	<94	94-107	108-120	121-134	135-143	>143
135	<97	97-111	112-124	125-139	140-149	>149
140	<101	101-115	116-129	130-144	145-154	>154
145	<104	104-119	120-133	134-149	150-160	>160
150	<108	108-123	124-138	139-155	156-165	>165
155	<112	112-127	128-143	144-160	161-171	>171
160	<115	115-131	132-147	148-165	166-176	>176
165	<119	119-135	136-152	153-170	171-182	>182
170	<122	122-139	140-156	157-175	176-187	>187
175	<126	127-144	145-161	162-180	181-193	>193
180	<130	130-148	149-166	167-185	186-198	>198
185	<133	133-152	153-170	171-191	192-204	>204
190	<137	137-156	157-175	176-196	197-209	>209
195	<140	140-160	161-179	180-201	202-215	>215

**Power Training Zones**

	Recovery	Endurance	Tempo	Threshold	Anaerobic	Max Effort
Threshold Power (Watts)	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6
200	<110	110-150	151-182	183-212	213-240	>240
210	<116	116-158	159-191	192-223	224-252	>252
220	<121	121-165	166-200	201-233	234-264	>264
230	<127	127-173	174-209	210-244	245-276	>276
240	<132	132-180	181-218	219-254	255-288	>288
250	<138	138-188	189-228	229-265	266-300	>300
260	<143	143-195	196-237	238-276	277-312	>312
270	<149	149-203	204-246	247-286	287-324	>324
280	<154	154-210	211-255	256-297	298-336	>336
290	<160	160-218	219-264	265-307	308-348	>348
300	<165	165-225	226-273	274-318	319-360	>360
310	<171	171-233	234-282	283-329	330-372	>372
320	<176	176-240	241-291	292-339	340-384	>384
330	<182	182-248	249-300	301-350	351-396	>396

If you don't have a heart rate monitor or power meter, it would be a good idea to consider getting one so that you can train with more specificity, but you can also train based on how you feel, or using perceived exertion. The **Rating of Perceived Exertion (RPE)** is useful to judge your effort when you don't have a heart rate monitor or power meter. Even if you do have these gadgets, it's still useful to understand how your body feels at these different intensities. RPE has traditionally used a 6-20 scale, but I am using the modified 1-10 scale as it is easier to remember. It is a subjective measure but once you get experience with it, you can quickly tell your RPE value. Here is the description of RPE:

- 0 = No effort (coasting)
- 1 = Very light (Zone 1)
- 2 = Light
- 3 = Moderate (Zone 2)
- 4 =
- 5 = Somewhat hard (Zone 3)
- 6 =
- 7 = Hard effort (Zone 4)
- 8 =
- 9 = Very Hard (Zone 5)
- 10= Maximal exertion (Zone 6)

### **III. Muscular Systems:**

Strength = ability to exert a force to overcome resistance

Endurance = ability to pedal over a prolonged time

Speed = ability to pedal quickly

Power = Work / Time; ability to exert sustained force for a period of time

The combination of these four muscular systems will contribute to success in cycling.

### **D. Training Adaptations**

Training is aimed at improving one or more of the three physiological systems. These include the following responses:

#### **Energy System responses:**

- Mitochondria density
- Fat burning enzymes
- Lactic acid tolerance

#### **Cardiovascular responses:**

- Blood volume
- Heart stroke volume

- Red blood cell content
- Capillary density
- lung/diaphragm capacity

**Muscular System responses:**

- Muscle mass
- Muscle fiber IIb shift to IIa
- Muscle strength
- Neuromuscular adaptation

**E. Training Plans and Sessions**

Training plans need to be developed to stress the various physiological systems to bring about the desired training responses. **Periodization** is the segmentation of a period of time into smaller periods of time, each of which has a specific purpose training. The overall training plan should be based on the year-long plan, called a **Macrocycle**. This macrocycle is divided into shorter periods of training called **Mesocycles**, lasting from 4 to 12 weeks in duration. There are one or more **Microcycles** within a mesocycle, each typically a week in duration. Within each microcycle are a series of **Training Sessions**. Each training session has a specific purpose to stress or recover one or more physiological systems.

**Macrocycle:** Typically a 12 month period covering the training and competition season.

**Mesocycles:**

**Transition** = the rest and recovery phase after a season or racing period

**Foundation** = begin conditioning for the upcoming season, develop off-season strength

**Base** = the aerobic endurance phase – getting your body used to long hours in the saddle

**Build** = increased aerobic and anaerobic capacity through intensive workouts

**Peak** = specific workouts to prepare for events, includes a taper period

**Race** = the event or series of closely occurring events for which you are focusing

The Build-Peak-Race mesocycles will be repeated 2-3 times per macrocycle.

The various physiological systems are trained at varying times during the macrocycle. The following is a rough guide to when each of these systems are trained.

Mesocycle	Strength	Endurance	Aerobic	Anaerobic	Speed
Foundation					
Base					
Build					
Peak					
Race					
Transition					

## **Examples of Mesocycles through the macrocycle:**

### **Transition Phase: October through early November**

Cross-train – run, mountain bike, hike, play basketball, swim, start weight training program. Continue to train the aerobic and strength systems, but in a less structured, fun way. Give your mind as well as your body a break.

### **Foundation Phase: November through December**

Prepare the body for the heavy training load coming in the Base phase. Begin more intense weight training sessions, become more specific in cycling workouts rather than cross-training. Work on strength endurance during this phase.

### **Base Phase: December through February**

Begin building an endurance base. Continue to train the muscular and aerobic systems. This phase trains the aerobic and muscular systems to take on the stresses of the Build and Race phases. Continue to work on strength endurance.

### **Build Phase: March through April (repeated again one or two times during season)**

Begin doing intensive training (intervals, hills, sprints, time trials). This is the most intense phase with the most physiological systems being trained. Overload is the intent here so built-in rest periods are essential.

### **Peak Phase: Two weeks prior to key race periods.**

A two week period prior to the Priority A races during the season. There may be 2 or 3 peak periods in a given macrocycle (year). This period reduces volume of training while continuing to maintain intensity: strength, speed, and power. This period ends with a few days of taper before the big event(s).

### **Race Phase: 2-3 peak races targeted for the year**

The race phase is typically a week, no more than two, where you are aiming for peak performance and which your entire season is focused. There may be 2 or 3 such race peaks in a given macrocycle (year).

### **Mid-season Transition: Week following Race Phase**

Up to one week of recovery rides following a peak race period in mid-season. The purpose here is to recover and rejuvenate both mentally and physically following an intense build, peak, and race period. The last transition phase of the season is longer and becomes the 'off-season'.

**Microcycles** are short (one week) periods of training within a mesocycle.

Examples of microcycles with training sessions:

Summer:

Monday: Recovery day – spin for 45 min

Tuesday: 6 all-out sprints in zone 5

Wednesday: Endurance – zones 2-3 for 2.5 hours

Thursday: Hill intervals

Friday: Recovery – day off bike

Saturday: 1 hour race prep with some spin-ups

Sunday: 40 mile road race

Winter:

Monday: Recovery day – spin for 30 min

Tuesday: 45 minute spin class

Wednesday: Upper body weight workout with 30 minute spin

Thursday: Leg weight workout with spinning in between sets

Friday: Day off

Saturday: Two 15-minute LT intervals on stationary trainer with 10 minute recovery in between

Sunday: 1.5 hour mountain bike ride

**Training sessions** are individual training workouts. There may be one or more training sessions per day. These are typically focused on one primary physiological system but also impact the other systems. Below is a set of workouts and the systems they emphasize.

Examples of Various Types of Cycle Training Workouts

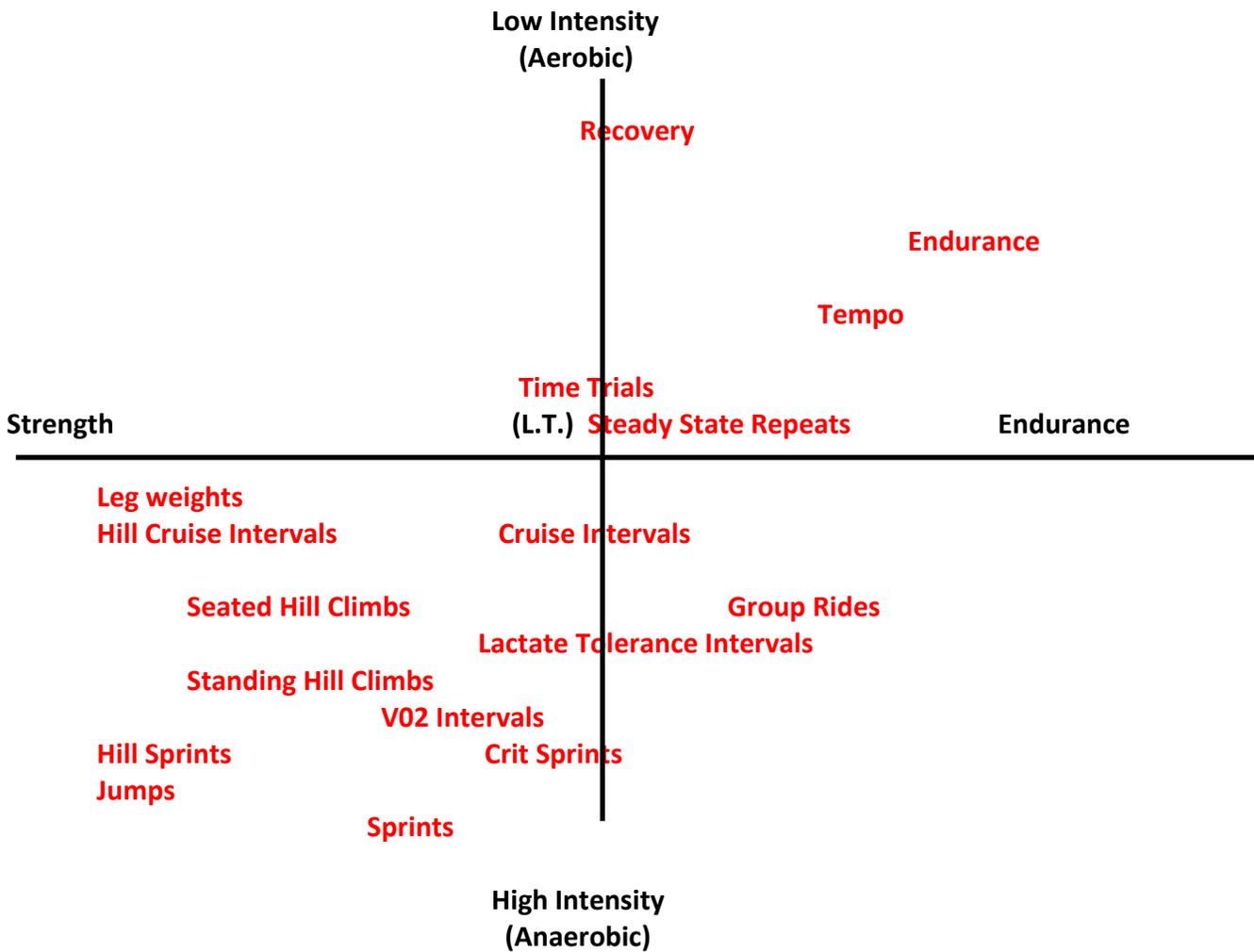
Code	Training Session	Description
	<b><u>RECOVERY</u></b>	
RE1	Recovery spin	Zone 1 easy spin
RE2	Cross training	skating/walking/mountain biking
	<b><u>ENDURANCE</u></b>	
EN1	Endurance ride	Zones 2-3, 2+ hours
	<b><u>STRENGTH</u></b>	
ST1	Upper body weight training	Upper body weight exercises, abdominal work
ST2	Leg weights	Squats, leg presses, leg extension, hamstring, calf raises
ST3	Seated hill climbs	Seated low RPM hill climbs
ST4	Standing hill climbs	Standing low RPM hill climbs
	<b><u>SPEED</u></b>	
SP1	Spin-ups	Build up and hold high RPM spins
SP2	Spinning	High RPM spinning for sustained period
SP3	Single leg spins	Spinning with one leg
SP4	Form sprints	sprint in low gear/high cadence to work on form
	<b><u>STRENGTH ENDURANCE</u></b>	
ME1	Tempo	Zone 3 sustained rides
ME2	Cruise intervals	6-12 minute intervals at zone 4
ME3	Steady state repeats	15-20 minute repeats, zone 3
ME4	Time trialing	20-40 minute time trial simulation
ME5	Hill cruise intervals	same as cruise intervals but uphill
	<b><u>POWER</u></b>	
PO1	Jumps	Explosive jump from standstill to max speed; high gear
PO2	Hill sprints	30 second uphill sprints
PO3	Crit sprints	30 second sprints out of corners
	<b><u>ANAEROBIC ENDURANCE</u></b>	
AN1	Group rides	High intensity group rides with attacks, sprints
AN2	Sprints	15 second intervals, max effort
AN3	Lactate tolerance	30 second to 2 minute intervals, zone 5
AN5	Pyramid intervals	Progressive intervals up and back down, zone 5
AN6	Hill intervals	Standing intervals uphill, zone 5
AN7	CP jumps	8 second jumps
Zone 1	< 60% of max	
Zone 2	60 – 70% of max	
Zone 3	70 - 85% of max	
Zone 4	85 - 95% of max	
Zone 5	> 95% of max	

Targeted Systems of Various Cycling Workouts

Training Session	Cardiovascular Zone					Energy System			Muscular System		
	1	2	3	4	5	CP	Aerobic	Anaerobic	Strength	Endurance	Speed
<b>RECOVERY</b>											
Recovery spin	A						B				
Cross training	A						B				
<b>ENDURANCE</b>											
Endurance ride		A					A		B	A	
<b>STRENGTH</b>											
Upper body weight training									A		
Leg weights									A		
Seated hill climbs				A				B	A		
Standing hill climbs				A				B	A		
<b>SPEED</b>											
Spin-ups		B					B				A
Spinning		B					B				A
Single leg spins		B					B				A
<b>STRENGTH ENDURANCE</b>											
Tempo			A	B			A		B	A	
Cruise intervals				A			A	B	B	A	
Steady state repeats				A			A		B	A	
Time trialing				A			A	B	B	A	
Hill cruise intervals				A			A	B	B	A	
<b>POWER</b>											
Jumps					A	A		B	A		
Hill sprints					A	B		A	A		
Crit sprints					A	A		A	A		B
<b>SPEED ENDURANCE</b>											
Group rides			A	A			A	B	B	A	
Sprints					B	A		B	B		A
Lactate tolerance					A			A	B	A	
VO2 intervals					A			A	B	A	
Pyramid intervals					A			A	B	A	
Hill intervals					A	B		A	A	A	
CP jumps					A	A		B			A

A = Primary systems, B = Secondary

The following diagram places these workouts according to the combination of physiological capabilities they train:



## The Training Pyramid

The various aspects of training build on each other, starting with a solid aerobic and strength base. The higher intensity anaerobic and sprinting workouts are built upon these other base proficiencies only after they are adequately developed. It can be thought of as a pyramid, where you build a solid base of aerobic and strength before building the peak aspects of your training. The size of each section of the pyramid is approximately proportional to the amount of your training volume you spend on each aspect. The vertical positioning also indicates when during the year you should be working on each. The closer to the bottom means this needs to be developed year round whereas the ones at the top should be worked on during the peak part of the season.



### **Suggested Reading**

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