

Using Training Peak WKO5+ Software to Build Training Programs for Vietnamese Road Cyclists

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Abstract Activity power device and volume and intensity of movement management software are tools and methods for measuring exercise and fitness for a given program or training period. This is a tool used by many scientists, managers, coaches and athletes to determine its practical application with high accuracy. The purpose of this article is to apply WKO5+ software to build personalized and specialized fitness development exercises in road cycling. Based on the training plan developed to prepare for the National Championship in 2021 and based on the parameters provided by the software, the coaching team have built 8 target exercise groups (These include Active recovery, Aerobic endurance, Aerobic endurance with rhythm, Close to Lactate threshold, Lactate threshold, Maximum oxygen absorption - VO₂ max, Anaerobic Power, Neuromuscular Power). These exercise groups, based on each athlete's functional threshold power and each training stage, closely follow the specialized energy zones of road cycling. This is the basis for the research team to apply to the management of the amount of movement by measuring the activity capacity according to the annual training plan of the Vietnamese road cycling team.

Keywords Use, Training Peak WKO5+, Software,

Build, Training Programs, Road Cyclists, Vietnamese

1. Introduction

The effectiveness of a training program is the result of manipulating motor quantity variables such as mass, intensity, and frequency [1]. The arrangement of the above variables depends on the psychomotor needs of the training or tournament goals. Therefore, the construction of exercises for road cycling must ensure that the movement variables meet the intensive psychophysiological needs such as aerobic, anaerobic and anaerobic endurance. The distribution of the variables of an exercise or training program must also ensure individualization, because adaptation to a specific amount of exercise varies among individual athletes [2]. Orienting the common basic principles in the arrangement of movement parameters of various types of target exercises in road cycling helps the coach to answer questions related to the construction of exercises when applying the equipment, capacity is measured (such as: Maximum number of repetitions of

strenuous exercise; Optimal interval of rest between reps) when to increase exercise intensity in the most appropriate way. Training Peak WKO5 software application to build a training program plays a very important role.

The procedure is that at the start of the training cycle, athletes are tested for general and specialized fitness tests, in which, the Functional Threshold Power (W/kg) test is an initial parameter entered into the WKO5+ software to individual training intensity zoning. Through the WKO5+ software application, the result is that 8 target exercise groups are chosen.

2. Materials and Methods

2.1. Research Object

Objects of the study: Training Peak WKO5+ software to build training programs for Vietnamese road cyclists.

Scope of the study: Training programs for Vietnamese road cyclists.

2.2. Research Design

The study used Training Peak Wko5+ software to store and analyze the time distribution of intensity zones of both heart rate and power measurement devices.

Based on the application process of exercise management device by power measuring device in training road cyclists, based on the experimental plan of the program of both teams (men and women), the research has used WKO5+ software to build exercises to develop specialized, personalized and specialized fitness goals in road cycling.

2.3. Proceed

The study was carried out from January to October 2021 at National Sports Training Center Ho Chi Minh City, Vietnam.

Common methods used in the process of carrying out research tasks include: Synthesis and methodological analysis of related documents; Pedagogical examination; Check psycho-physiological function; Statistics and calculations [3]. Power meters are rapidly becoming an invaluable part of training and racing among professional cyclists. For coaches and athletes, these devices offer enormous potential for targeting and timing training to realize a rider's goals [4]. Activity monitoring devices include the Rotor Power Activity Recorder (mounted on each athlete's dedicated bike pedal) and Garmin heart rate monitor.

2.4. Participants

In order to assess the current status of the application of science and technology in training high-level athletes in road cycling, the study conducted interviews with 10

coaches representing 10 long-distance cycling teams of the provinces/cities. These subjects have had good achievements at national and international tournaments along with 02 coaches of the Vietnamese national road bicycle men's and women's team. A total of 12 votes were given out. 12 valid votes were collected, and the rate was 100%. To select the index/test to assess the fitness level of road cycling in accordance with new technological equipment, the study conducted two interviews on the same subject. The first interview was 2 weeks after the second interview. The interview form was sent to 12 experts, scientists and coaches (see Table 1).

Table 1. Descriptive statistics on the characteristics of the coaches participating in the survey (n=12)

	Content	Frequency	Ratio%
Academic level	Bachelor	3	25
	Master	9	75
	Doctor	0	0
Current training level	National team	2	16.6
	Provincial/city team	10	83.3
	Other	0	0
Level of training previously undertaken	National team	4	33.3
	Provincial/city team	8	66.6
	Other	0	0
Seniority of professional work	From 15-20 years	7	58.3
	From 20-25 years	3	25
	Over 25 years	2	16.6

Research object: A total of 7 athletes at the national level of long-distance cycling in Vietnam, gathered at the National Sports Training Center in Ho Chi Minh City, campus 2. Of note. All participants had no history of injury and chronic illness. They start and finish a road cyclists training program without injury and illness. Among them, 4 female athletes (mean \pm standard deviation of height is 159.0 cm \pm 3.1; weight is 59.2 \pm 2.9 kg and training experience is 12 \pm 1.5 years). And 3 male athletes (mean \pm standard deviation of height is 170.8 cm \pm 2.75; of weight is 62.6 kg \pm 4.21 and training experience is 13 years \pm 1 (see Table 2).

Table 2. Physical characteristics of the participants

	Height (cm)	Weight (kg)	Training experience (y)
Male	170.8 \pm 2.75	59.2 \pm 2.9	12.0 \pm 1.5
Female	159.0 \pm 3.1	62.6 \pm 4.21	13.0 \pm 1.0

At the beginning of the training period and cycle, athletes are tested with general and specialized fitness tests, in which the Functional Threshold Power (W/kg) test is an initial parameter. It is imported into WKO5+ software for

individual training intensity partitioning. After syncing accounts, personal information and some general fitness stats of athletes are entered into the software as shown in Figure 1.

At the first window of the software, the general fitness index at the beginning of the cycle is entered into the software as shown above. As soon as the parameters are entered, the software's algorithm will determine the intensity partition for each athlete at different levels of exercise power and heart rate. In the Zone window (Red area - below picture), the software's algorithm gives the training intensity area according to the power with 8 basic zones (iLevel for Cycling). In parallel, the software also

calculates and gives power interval, optimal number of repetitions for each exercise interval for high-intensity exercise types, anaerobic and aerobic capacity development (Optimized Interval Targets Cycling). Specific illustrations are presented in Figure 2 and Figure 3.

Based on the application process of the power metering device in the training of long-distance track athletes, along with the experimental plan of the program of both teams (men and women), the research has applied WKO5+ software to build exercises to develop specialized, personalized fitness in road cycling.

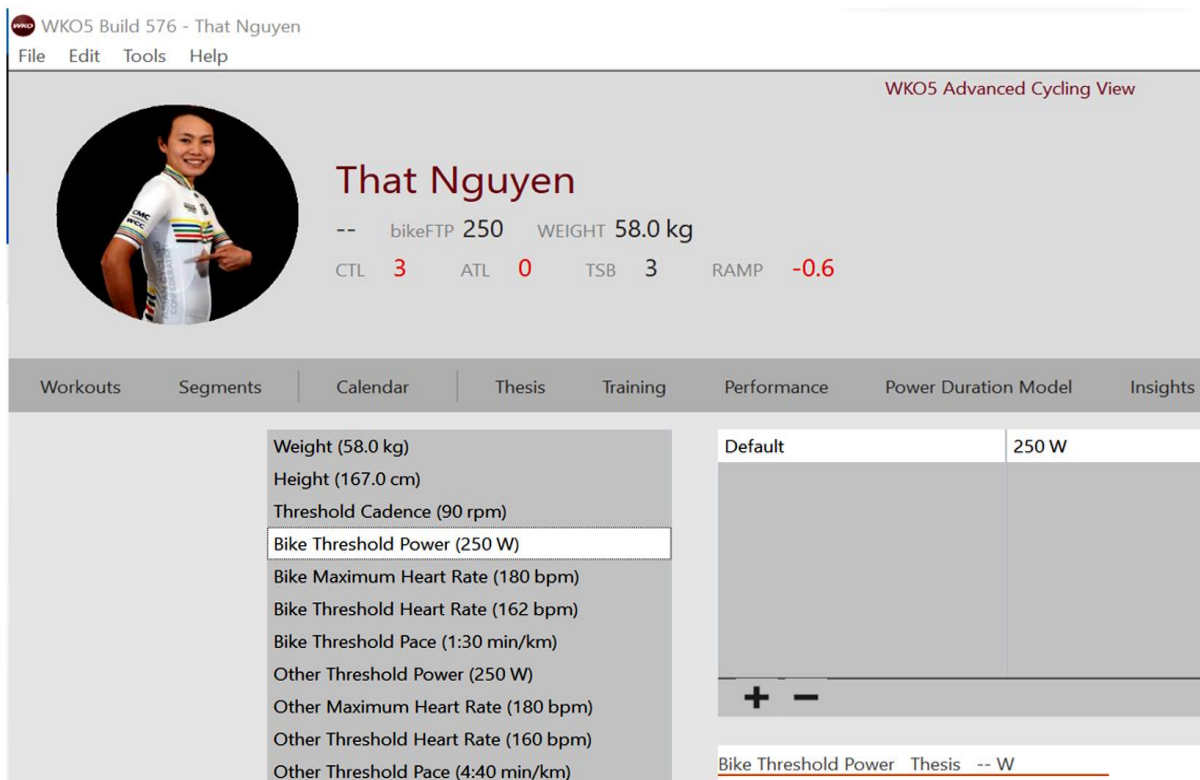


Figure 1. Athlete's personal information and some physical fitness metrics are initially entered into the WKO5+ software

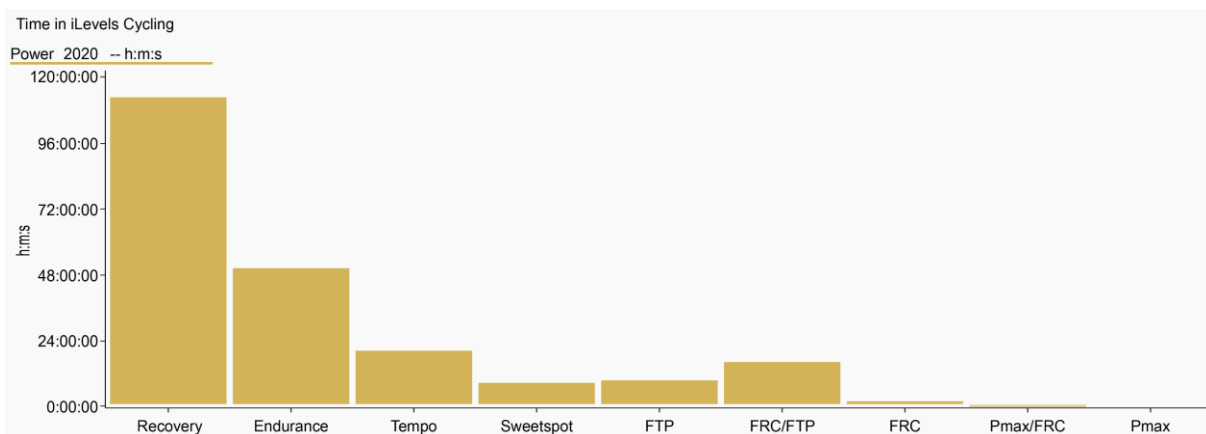


Figure 2. The software partitions the intensity of exercise according to each athlete's capacity

Optimized Interval Targets Cycling - Last 90 Days

Thesis

Level	Energy System h:m:s	Reps Estimate Progressive	Total TiZ Estimate Progressive	Recovery Time Estimate Ratio
Pmax	Max	5-10	>1 min	7-12 Min (Full)
Pmax/FRC	Intensive Anaerobic (FRC)	4-10	>2 mins	7-8 Min (Full)
FRC	Extensive Anaerobic (FRC)	3-12	4-12 mins	1:2 to 1:10 (Ratio of Interval to Rest)
FRC/FTP	Max Aerobic	3-8	12-30 mins	1:1 (Ratio of Interval to Rest)
FRC/FTP	Intensive Anaerobic (FTP)	1-4	30-90 mins	<5 min
FTP	Extensive Anaerobic (FTP)	1	TTE	NA

Figure 3. Optimal power range and number of repetitions for each intensity zone

2.5. Statistical Analysis

We have used SPSS software version 26, Microsoft 365 ver 18.204, TrainingPeak WKO5 application software (Peakware LLC, Colorado, USA), Lactate E analysis software (Nui Galway) to process some data such as: Descriptive Analysis, Comparison analysis, Association analysis, prediction analysis. All data were analyzed using SPSS version 22 (SPSS Inc., USA) at a significance level of 0.05.

3. Result and Discussion

3.1. Principles of Building Aerobic, Anaerobic, and Anaerobic Exercises at Intervals when Applying Power Measurement Equipment

a. Training according to the movement energy source

Alactic (non-lactate) intensity zone: non-lactate energy system (AST) training is for increasing speed with less exertion, typically improving power at the start and acceleration ability. The optimal training interval for this zone is between 3 and 8 seconds, with a speed or exertion power around 95% of maximum. The exercise capacity in this area is at high intensity. The energy source CP (Creatine Phosphate), the enzymes that release the ATP and ATP energy sources are often exhausted, so the interval between exercises is often long [1].

Lactate Intensity Zone: Training at a lactate power source increases the ability to perform strenuous exercise when lactate is produced, and increases endurance when large amounts of lactate accumulate in the muscles. Maximum intensity exercise repeated over 40 to 50 seconds intervals results in a very high increase in lactate accumulation, the highest lactate production rates being observed during maximal exercise (for a period of 12 to 16 seconds). According to Bompa [5], optimal lactate zone exercises should be in the range of 15 to 90 seconds. In addition to the ability to increase exercise capacity and lactate tolerance, strenuous exercise in this region also optimizes metabolic enzymes and the adaptation of the motor nervous system.

Zone of maximal oxygen uptake (VO_2 max): oxygen delivery to muscles often represents the limit of athletic

performance, because athletes are capable of absorbing a volume of oxygen. Biggers are generally seen as better performers in endurance sports such as road cycling. So, training in the maximum oxygen absorption energy zone should be noticed by coaches and athletes alike. Training in this energy area helps the heart contract more strongly; improves the ability to transport oxygen to the peripheral areas; increases the ability of the muscle system to use oxygen. According to Bompa [5], to be effective in training in this area, the duration of maximal physical exertion should be between 1 minute and 6 minutes at an intensity of 95% to 100% of maximal oxygen uptake.

Anaerobic Threshold: Training in the anaerobic threshold is an exercise at an intensity where the rate at which lactate is produced or lactate diffuses in the blood is equal to the rate at which lactate is eliminated. The lactate produced will diffuse into adjacent non-active (resting) muscles, so concentrations will be low. Muscle metabolism removes lactate from the blood by the heart and liver. According to Bompa [5], exercises in this zone usually last 1 to 6 minutes, similar to the zone of maximum oxygen absorption intensity, but at a lower intensity level of about 85% to 96% of oxygen absorption maximum.

Aerobic Threshold: It is clear that high aerobic endurance capacity is the determining factor for moderate and long endurance events. Training in this intensity zone is also important for optimizing the ability to recover quickly during high-intensity training or competition events. Training in this intensity zone helps to optimize the cardiopulmonary system, nervous system and metabolic efficiency. Bompa [5] suggests that exercises in this intensity zone usually last long without a break, or with a break between repetitions of up to 10 minutes, optimal training time from 1 hour to 2 hours. The optimal concentration of lactate in the blood is between 2mmol and 3mmol.

Aerobic Compensation: This intensity zone helps athletes recover from an intense workout or a competition session. Especially, the process of exercise in this intensity zone helps to eliminate intermediate metabolites in the energy production process, simultaneously accelerate the process of recovery and energy regeneration in the muscle. Exercises in this intensity zone should be added after each training session and last 15 to 20 minutes, or alternate between repetitions of maximal and submaximal intensity

exercises [2].

b. Principles of increasing/decreasing the number of repetitions of high-intensity interval exercises (Work-to-Rest Intervals)

According to Bompa [5], road cycling often has attacks with short and long durations ranging from 5 seconds to several minutes. Therefore, interval training exercises must also have a specific distribution of intensity between rest and maximal exertion.

Research by Hunter Allen [4] has collected more than 3000 data files on the locomotor capacity of more than 1000 high-level road cyclists. The author has also proposed the principle of increasing/decreasing the number of repetitions of intense and specialized interval exercises for road cycling. Specific data are shown in Table 3.

The principles of building exercises based on the main energy zones and the principles of increasing/decreasing the number of repetitions of high-intensity interval exercises (Work-to-Rest Intervals) specific to road cycling are shown in the table above. It shows that in order to optimize specialized motor competencies such as aerobic, anaerobic, and anaerobic capacity, as well as specific training goals in road cycling, the coach/athlete needs to ensure compliance with scientific and systematic training principles. The exercise building principles above are not best practices, but are scientific and systematic practices that works for most road cyclists [3].

Table 3. Principles of increasing/decreasing the number of repetitions for each interval exercise and exerted capacity

No	Exercise time	% average power losse valuation
1	20 minutes	3 - 5%
2	10 minutes	4 - 6%
3	5 minutes	5 - 7%
4	3 minutes	8 - 9%
5	2 minutes	10 - 12%
6	1 minute	10 - 12%
7	30 seconds	12 - 15%
8	15 seconds	10 - 15%
9	15 - 20% with maximum power from 5 - 10 seconds	

Note: This percentage of power loss is usually based on the exercise capacity of a given interval of time at the 3rd rep. For example, when performing a 5-minute strenuous capacity exercise with multiple repetitions, the athlete must stop for rest if the power decline is 5 - 7% from the 3rd rep.

3.2. WK05+ Software Application to Build Exercises according to In-Depth Goals

Based on the training plan developed for Vietnam National Championship 2021, the specific training goals of each week together with the parameters provided by the software, the training board builds 8 groups of target exercises based on the FTP and FTTHR of each athlete. This

process is carried out in stages of training as well as following the specific energy zones of the road bike.

Exercise group 1: Active recovery. This is a focus group of exercises that are mainly used for basic endurance preparation or for the recovery phase of high-intensity exercises and after the main training session. The main task of active recovery is to remove by-products in the muscles and circulatory system after a period or for exercises with high energy metabolism. This group of exercises usually lasts 1 hour to 1 hour 30 minutes [6]. Typical Active Recovery exercises are presented in Table 4.

Table 4. Active recovery exercises

AR-W2	Time	Describe	% FTP	% FTTHR
Cycling	90 minutes	Pedaling evenly, gently	<55	<68

Exercise group 2: Aerobic endurance exercise. This group of exercises focuses on developing basic aerobic endurance, developing the cardiopulmonary circulatory system as well as the mitochondrial nucleus, developing the capillary system that carries oxygen in the muscles. The training time of this group of exercises usually lasts 2.5 hours to 3.5 hours or longer. The pedal rhythm is maintained at about 90 rpm and can combine high-powered exercises in the range of 5 to 10 seconds. With a cycle of 95 to 120 rpm, the longer this exercise lasts, the better the athletes prepared will be for endurance and recovery for periods of intense training. The group of Aerobic Endurance exercises is shown in Table 5.

Tomlin. DL. [7] suggested that aerobic metabolism plays an important role in athletic performance, and sometimes contributes directly to athletic performance, as well as athlete's recovery. Appropriate aerobic endurance training programs not only help athletes develop simple endurance capacity, but also help maintain exercise capacity in the exercises themselves at certain intervals and recover as quickly as possible for the next exercises.

Research by Buchheit, M, and Laursen, PB (2013), Gaesser, GA. (1988), Laursen, PB (2010) showed that aerobic endurance development programs are often developed at sub-threshold intensity and high intensity intervals, helping to clearly develop the body to absorb maximum oxygen. VO_{2max} (ml/kg/min) and Lactate threshold [8, 9, 10].

The research of Astrand's. PO [11] showed that an aerobic endurance training program can improve aerobic capacity by 5% to 30% depending on the athlete's fitness level or individual adaptation level.

Group of exercises 3: Aerobic endurance with rhythm (Tempo). This group of exercises can be seen as the intermediate point between aerobic exercise and high-intensity, speed, and anaerobic exercise. This one usually focuses on a certain intensity or speed and lasts for a certain period of time, or can randomly customize any intensity and maintain for certain periods of time (similar to Farlek exercises). The physiological adaptive impact of this group

of cards is huge because it helps to initially work on most of the major energy sources. The training time of this group lasted 2.5 to 3 hours. Aerobic Endurance exercises according to the rhythm is shown in Table 6.

Exercise group 4: Close to Lactate threshold (Sub-Threshold/Sweet Spot). This group of exercises according to Hunter Allen [4] is very important for athletes to start approaching and improving mobility at the lactate threshold. The goal of exercise at this threshold is to help athletes be able to maintain near-threshold for a long time without too much loss of capacity when training or competing at higher intensity, as well as supporting their movement. Athletes may approach exercises at or above the lactate threshold better. The exercises are not too heavy, but maintain a high pedal speed (from 100 to over 105 rpm). Exercise time ranges from 2 hours to 2.5 hours. The group of Lactate threshold exercises is shown in Table 7.

Exercise group 5: Lactate threshold. Training at lactate threshold means focusing on developing functional threshold power (FTP). This group of exercises requires a high degree of exertion and stress. It is a very important group of exercises and helps to improve athletes' fitness levels and is closely related to individuals' and teammates' timed performance. These also enable athletes to endure more intense workouts due to the intense nature of the

exercise. Specifically, the rest intervals are usually longer and usually lasts 1.5 and 2.5 hours [2]. The group of Lactate Threshold exercises is shown in Table 8.

Sokolovas G. [12] conducted a study on 25 swimmers with ages ranging from 12 to 19 years old to determine lactate threshold through 4 x 300m test (step-up test). The results showed that athletes' lactate concentration was very different, even the lactate concentration at each level of exertion and the maximum lactate concentration after maximum exertion with an amplitude ranging from 3.23 mmol/L to 20 mmol. /L. This proves that athletes' lactate threshold is affected by age and training level. The difference in Lactate concentration depends on the amount of exercise of each athlete (depended on specific content) [12].

While Jan Olbrecht [13], who contributed to the success of swimming at the Rio Olympics with 2 gold, 10 silver and 3 bronze in the 100m freestyle, 4x100m, 2x200m, is also the author of the very Famous - The Science of Winning. He believes that for high-performance athletes (for cyclists - W/kg, swimmers - m/s), there is no scientific evidence that athletes can operate at high capacity than at threshold V4 (4 mmol/L). Therefore, the V4 threshold is an important measure to assess training intensity as well as performance in competition.

Table 5. Aerobic endurance exercise

END-W4	Time	Describe	%FTP	%FTHR
Warm-up	15 minutes	Gently pedal, 90-100 v/ph	56-75	69-83
Exercises	2-2.5 hours	Aerobic endurance + maximum exercise, 90-95 rpm	70-85	84-90
	10 x 8 seconds	Maximum exertion, 105+ rpm	150	N/A
Relaxation	10-15 minutes	Pedaling relaxation	56-75	69-83

Table 6. Aerobic endurance exercise with rhythm

TEMPO-W5	Time	Describe	%FTP	%FTHR
Warm-up	15 minutes	Pedaling gently	56-75	69-83
Exercises	3 minutes	Maximum exertion	115-120	>105
	5 x 1 minutes (1 minute RI)	Increase the lap speed, 100+ rpm	56-75	69-83
	20 minutes	Aerobic regular rhythm, +5 rpm	56-75	69-83
	1 hour	Aerobic + top speed	76-90	85-94
	20 x 20 seconds (2.5 minute RI)	Maximum repetition speed	100	N/A
Relaxation	10 minutes	Pedaling relaxation	56-75	69-83

Table 7. Lactate Threshold Exercise (Sub-Threshold/Sweet Spot)

SUBLT-W7	Time	Describe	%FTP	%FTHR
Warm-up	15 minutes	Pedaling gently	56-75	69-83
Exercises	3 x 10 min (3 min. RI)	Sub - Lactate	88-93	92-98
	4 x 3-4 min. (4 min. RI)	Take a pass or a big plate	110-115	84-88
	5 x 1 min. (1 min. RI)	A high pedal speed, 110+ rpm	<90	<80
Relaxation	10 minutes	Pedaling relaxation	56-75	69-83

Table 8. Lactate threshold exercise

LT-W20	Time	Describe	%FTP	%FTHR
Warm-up	10 minutes	Grow aerobically with 3 x 1 min. Fast pedaling speed, 110+ rpm	56-75	69-83
	1 hour	Build endurance with FTP thresholds on flat or ramps at sustained lap speeds	56-75	69-83
Exercises	5 x 4 min. (1 min. RI)	Intensity at FTP interval	90	95-100
	5 minutes	Relax between each nest, 85-105 rpm	56-75	69-83
	5 x 4 min. (1 min. RI)	Intensity at FTP interval	90	95-100
	10 minutes	Endurance, 85-105 rpm	56-75	69-83
	20 minutes	Endurance to the beat	76-90	84-94
	Relaxation	5 minutes	Gently pedal	<55

Exercise group 6: Maximum oxygen absorption - VO₂ max. As the group's name suggests, the goal is to develop capacity at a time when oxygen uptake is the greatest. As mentioned, the ability to maintain maximum capacity at maximum oxygen uptake is usually between 3 and 8 minutes depending on the level of each athlete. So, building exercises and training programs staying at this intensity often have to be constantly adjusted to accommodate all athletes in the same team [6]. The weekly program often adjusts the duration of exertion and rest to match the training parameters that the WKO5+ software recommends for each athlete. The development of motor capacity in this intensity zone brings many benefits and advantages in the process of actual competition such as group attacks, leading groups..., from that creating tactical advantages to win the race. The group of exercises that Absorb Maximum Oxygen - VO₂ max is illustrated in Table 9.

Another study result by Mac Dougal and colleagues [4] showed the development of maximum PPO power (W/kg), 30-second anaerobic power (W/kg) and maximum oxygen absorption volume VO₂max (ml/kg/min) for a 7-week program of high-intensity supralactate and high-intensity interval training.

Similar to the above research results, Tabata and colleagues [15] suggested that the maximum oxygen absorption volume, or aerobic capacity at certain intervals, is best developed for exercises in the high altitude region. The research shows improvements in aerobic endurance capacity of up to 9% - 15% for a 6-week training program.

Exercise group 7: Anaerobic Power. Anaerobic exercise capacity usually lasts only about 2 minutes or less. Exercises at this capacity are intense and require maximum exertion in a short period of time. These are difficult to

perform accurately without force gauges and data reading software. Due to the short duration of maximum exertion, the heart rate cannot respond to the work done so it is difficult to accurately determine the amount of exercise within the threshold. There is a huge difference in anaerobic training at intervals of 30 seconds to 2 minutes. Therefore, there is a lot of customization in the training and training program in the anaerobic power group. To ensure good adaptation for these groups of exercises, the trainer must use the WKO5+ software and adjust the appropriate amount of exercise for each athlete. The group of Anaerobic Power exercises is illustrated in Table 10.

Exercise group 8: Neuromuscular Power. This is a group of exercises that the coach focuses on for athletes with good maximum speed ability, capable of competing for rankings when finishing a large group at multi-stage or single-stage competitions. As the name suggests, this group of exercises requires maximum power at a very short interval of about 10 seconds, so these put a lot of stress on the neuromuscular and muscular systems rather than the energy exchange system. For this group of exercises, athletes are required technical handling skills to control the bike and the track at short distances. It is almost impossible to know the speed, power and heart rate during exertion. Therefore, it is necessary to collect data to determine the response to the exercises in this group. To ensure the level of response for this group of exercises, the coaching board often builds in the professional preparation stage, the frequency and timing of training based on the athlete's best physical condition. This group of exercises can be combined with the groups of exercises from intensity zone 3 to zone 5 [6]. The group of Neuromuscular Capacity exercises are presented in Table 11.

Table 9. Maximum oxygen absorption exercise - VO₂ max

VO2-W6	Time	Describe	%FTP	%FTHR
Warm-up	20 minutes	Gently pedal	56-75	69-83
Exercises	5 x 1 minutes. (1 min. RI)	Fast pedaling, 110+ rpm	<80	<90
	5 minutes	The rhythm is aerobic	56-75	69-83
	5-8 x 5 min. (5-6 min.RI)	Large capacity spaced	100-110	100-105
	30 seconds	Maximum speed at 300% FTP	200+	N/A
	3 minutes	Make every effort	100-110	100-105
	10 seconds	Top speed to the finish line	200+	N/A
	8 x 1min. (1min. RI)	Fast pedaling, 110+ rpm	<80	<90
Relaxation	15 minutes	Pedal relax	56-75	69-83

Table 10. Anaerobic Power Exercise

AC-W7	Time	Describe	%FTP	%FTHR
Warm-up	20 minutes	Gently pedal	56-75	69-83
Exercises	6 x 2 min. (1 min. RI)	Anaerobic power	>135	>105
	5 minutes	Gently pedal	<75	<83
	6 x 1 min. (1 min. RI)	Anaerobic power	>150	>105
	5 minutes	Gently pedal	<75	<83
	6 x 30 seconds (1 min. RI)	Maximum exertion	200	N/A
Relaxation	15 minutes	Pedal relax	56-75	69-83

Table 11. Neuromuscular power exercise

NP-W5	Time	Describe	%FTP	%FTHR
Warm-up	15 ph út	Gently pedal	56-75	69-83
Exercises	6 x 50 m (2-3 ph. RI)	Pedal the small disc at 10rpm, gradually increasing the pedal to 120 rpm	max	N/A
	3 x 250 m (3-5 ph. RI)	Top speed with 53 discs: 17 from 20 rpm, Lift the gears, speed up 110-120v/min	max	N/A
	3 x 250 m (3-5 ph. RI)	Top speed with 53 discs: 17 from 20 rpm. Lift the gears, speed up 110-120v/min	max	N/A
	250 m	Top speed with 53 gear 15 discs at 26 to 28 mph, acceleration up 110 120rpm	max	N/A
Relaxation	20-30 ph út	Gently pedal	56-75	69-83

3.3. WKO5+ Software Application to Build Exercises according to In-Depth Goals

Adjust daily activity for high-intensity exercise: For high-intensity exercise, especially high-intensity interval training, it is very difficult to set the optimal amount of exercise for each athlete. For example, setting the maximum exercise capacity of 1 minute for 1 exercise, according to Hunter Allen [4], can be done in 2 ways: 1) The number of repetitions performed until exhaustion; 2)

Reduce the time in each exercise so that the motor capacity can be maintained. However, Hunter Allen [4] also thinks that these two ways are very difficult to optimize the energy to develop as well as ensure not to be overloaded during exercise. Hunter Allen's Table of Increases/Decreases for each interval of exercise capacity helps trainers decide whether to increase or decrease the number of repetitions toward their capacity of the previous ones. There is a decrease or still ensure the source of exercise energy for each certain period of exertion, which helps to optimize

training goals and avoids overloading the daily amount of exercise. In addition, the Training Peak WKO5+ software also provides an estimate of the appropriate number of repetitions of each maximum exertion interval for each athlete [4].

Managing fitness and fatigue, adjusting exercise weekly and monthly: As mentioned, ATL is a proxy for the short-term impact of exercise over a two-weeks period before. When ATL is high, fatigue will be increased. On the contrary, it means that the amount of previous exercise is reduced and the stress level on the athlete is also lower. An increase or decrease of ATL affects the adaptive locomotor index (CTL), which will represents fitness 42 days (6 weeks) later. Obviously, if ATL is continuously elevated, in the following weeks, the amount of exercise must be reduced to ensure the balance of physical state or the balance between fatigue and fitness. Hunter Allen [4] recommends adjusting ATL based on Training Peak WKO5+ software as follows to ensure compliance. Adjustment of ATL by age is shown in Table 12.

Table 12. Adjusted ATL by age [4]

Age	Adjustment Time ATL
<19	2 – 4 days
20 – 29	4 – 7 days
30 - 49	6 – 8 days

4. Conclusions

Through the application process of the power metering device in the training of road cyclists, the research has applied WKO5+ software to build some exercises for developing their personalization and specializes fitness. At the beginning of the training cycle, athletes are tested with general and specialized fitness tests, in which the Functional Threshold Power (W/kg) test is an initial parameter which is imported into WKO5+ software for individual training intensity partitioning.

Based on the training plan developed in preparation for the Vietnam National Championship 2021 and together with the parameters provided by the software, the coaching team has built 8 groups of targeted exercises depending on the FTP and FTTH of each team. These exercises are applied to athletes in each training phase and adhere to the specific energy zones of the road cycling.

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REFERENCES

- [1] Aryanto., Budi & Hariono., Awan & Pahalawidi., Cukup, "The Validity and Reliability Construct Skills Assessments Skill in Korfball by Using Exploratory Factor Analysis and Confirmatory Factor Analysis", International Journal of Human Movement and Sports Sciences, vol. 9, no. 2, pp. 231-235, 2021. DOI: 10.13189/saj.2021.090210.
- [2] T. Maier, L. Schmid, B. Müller, T. Steiner & J. P. Wehrin, "Accuracy of Cycling Power Meters against a Mathematical Model of Treadmill Cycling", International Journal of Sports Medicine, 38 (6), pp. 456-461, 2007. DOI: 10.1055/s-0043-102945.
- [3] Duong Nghiep Chi, Tran Duc Dung, Ta Huu Hieu, Nguyen Duc Van, "Sports Measurement", Sports Publishing House, 2004, pp. 85-92.
- [4] Hermann Maier, Hunter Allen, Andrew Coggan, "Training and racing with a power meter", Velopress, 2006, pp. 123-136.
- [5] Tudor O. Bompa, G. Gregory Haff, "Periodization: Theory and Methodology of Training", 5th ed, Library of Congress Cataloging-in-Publication Data, Human Kinetics, 2009, pp. 23-35.
- [6] Robert J. Gregor, "Handbook of Sports Medicine and Science: Road Cycling", 1st.
- [7] D. L. Tomlin & H. A. Wenger (2001). "The relationship between aerobic fitness and recovery from high intensity intermittent exercise". Sports Med. 31 (1), 1-11. DOI: 10.2165/00007256-200131010-00001.
- [8] G. A. Gaesser & L. A. Wilson (1988). "Effects of continuous and interval training on the parameters of the power-endurance time relationship for high-intensity exercise". Int J Sports Med. 9 (6), 417-21. DOI: 10.1055/s-2007-1025043.
- [9] P. B. Laursen (2010). "Training for intense exercise performance: high-intensity or high-volume training?". Scand J Med Sci Sports. 20 Suppl 2 1-10. DOI: 10.1111/j.1600-0838.2010.01184.x.
- [10] Martin Buchheit & Paul Laursen (2013). "High-Intensity Interval Training, Solutions to the Programming Puzzle - Part II: Anaerobic Energy, Neuromuscular Load and Practical Applications". Sports medicine (Auckland, N.Z.).
- [11] PO. Åstrand, Rodahl, K. Dahl, HA, and Stromme. SB (2003). "Textbook of Work Physiology". Champaign, IL: Human Kinetics., 4th Ed 242-243.
- [12] G Sokolovas (2003). "Lactate clearance after the race". Coaches Quarterly. 9 3-7.
- [13] Jan Olbrecht (2000). The science of winning: planning, periodizing and optimizing swim training. F & G Partners.
- [14] J. D. MacDougall, A. L. Hicks, J. R. MacDonald, R. S. McKelvie, H. J. Green & K. M. Smith (1998). "Muscle performance and enzymatic adaptations to sprint interval training". J Appl Physiol (1985). 84 (6), 2138-42. DOI: 10.1152/jappl.1998.84.6.2138.
- [15] Tabata, K. Nishimura, M. Kouzaki, Y. Hirai, F. Ogita, M. Miyachi & K. Yamamoto (1996). "Effects of moderate-

intensity endurance and high-intensity intermittent training on anaerobic capacity and VO_2max ". *Med Sci Sports Exerc.*

28 (10), 1327-30. DOI: 10.1097/00005768-199610000-00018.