Long term physical athlete development plan

Creation of age-appropriate physical athlete development and training plans in orienteering.

Contents:

Orienteering requirements

Fast running is required in a sprint (4,5min/km as average, < 3min/km actual running speed), agility and power are required in difficult terrain (winning times with 10 min/km pace are not uncommon in Elite classes in certain competitions).

1. ENDURANCE

Orienteering is an endurance sport.
A meaningful subdivision of the endurance is mainly carried out according to the length of the load (this is also related to the different energy production processes in the body). Essentially, a distinction is made between short-term endurance (35 sec. - 2 min.), medium endurance (2 - 10 min.) and long-term stamina (over 10 min.).

See also in detail the following overview:

Functional system	Unit measure	Short 35s – 2min	Medium 2-10 min	Long I 10-35 min	Long II 35-90 min	Long III 90-360 min	Long IV > 360 min
Cardiovascular	HR (beats/min)	185-200	190-200	180-190	175–190	150-180	120-170
O_2 intake	% VO_2 max	100	95-100	90-95	80-95	60-90	50-60
Energy conversion	% proportion aerobic anaerobic	20 80	60 40	70 30	80 20	95 5	99 (1)
Energy consumption	KJ/min Total KJ	250 380-460	190 545-1680	120 1680-3150	105 3150-9660	80 9660-27000	75 >27000
Glycogen breakdown	% Muscle glycogen	10	30	40	60	80	95
Lipolysis	FFS mmol/l	0,5	0,	0,8	1,0	2,0	2,5
Glycolysis	Lactate mmol/l	18	20	14	8	4	2
Proteolysis	Alanine μ mmol/l	500	500	400	350	250	200

Use of functional systems for different endurance competition performances (I.O.F.)

Summary:
- Looking at orienteering competitions expected winning times, one finds that all competitions are based on long-term endurance. The heart rate is at the highest level throughout the entire competition (near the maximum heart rate).

- The absolute running speed (pace) is defined by the terrain/forest.
- The short breaks at the control locations are not actual breaks.
- On slopes lactate is produced, which, however, can be degraded during downhill running or during stretches through the thicket (often during the competition already).
- In case of mistakes, there are sometimes (unwanted) rewarding breaks.

2. STRENGTH

Naturally, of all strength abilities in orienteering, strength endurance has the greatest importance, while speed strength and maximum strength in ideal-typical form assume only small importance. In particular, a specific muscle cross-sectional training (with devices) would have the advantage of improving strength capabilities, but also the disadvantage of an unwanted weight gain in runners. On one hand, it is important to have a well-developed core musculature so that power transmission from the legs to the center of gravity can be applied - due to rough terrain this stabilization work is of great importance. On the other hand, the generation of power through the strength of the body on the ground make the "measure" of the speed in the forest. Then the force of the legs on / against the ground, in which one does not know exactly in advance which forces can return, requires a high degree of specific coordination and endurance.
In general, regular stabilization training (trunk stabilization, feet exercises, etc.) is essential in running training and, in particular, in orienteering training.

3. SPEED

The speed is of minor importance in orienteering due to the duration of the main competitions. Of course, the speed is the determining factor for the maximum running speed. In any case, a good speed level is not a disadvantage. If the speed level falls below a certain value, this would also mean that higher speeds cannot be reached on longer distances.

In certain situations, however, the level of speed may also be more important in orienteering as:

- Greater reserves are available for further performance
- Greater chances of victory in the final part of competition (e.g. relays)
- More control of speed around average race speed
- More possibilities in race tactics

In these situations it may be that an ability, commonly referred to as "speed endurance", prevails. In speed endurance, the limiting factor is the output rate in anaerobic metabolism (glycolysis). This is of particular importance in orienteering, because it causes a lack of oxygen in the brain and a deterioration in the cognitive performance (map reading). On the other hand, there is hardly any chance in the remaining of the run to reduce the lactate to steady state (lactate degradation capacity) according to the latest knowledge in orienteering [Prof. Tonkonogi, Professor Medical Science of Dalarna University in Falun/Borlange, “High Performance Sport and Studies”, section “Specific Training for Orienteering”].

4. AGILITY

Flexibility in orienteering is not a performance-determining component like endurance. Nevertheless, its importance should not be underestimated. On one hand, it allows for large volumes of movement and, on the other hand, it is a prerequisite for injury-prevention. The mobility is also important to keep the effort required for unrhythmic movements when running on uneven surfaces/terrain.

5. COORDINATION

A distinction is made between seven components of coordination skills, which are of relevant importance for orienteering. In this case, orienteering can be classified as a sport with very high coordination requirement. Coordination exercises in various forms - in addition to the ongoing coordination training by running on track or orienteering training itself - should be a fixed component in orienteering training:

- Balance ability:
it is the ability to keep the whole body in equilibrium or to maintain/restore it during and after extensive body movements. To run in the forest, balance is really important for orienteers (and it increases proportionally with the degree of difficulty of the course).
- Orientation ability:
this is the ability to determine and change the position and movement of the body in space and time, based on a defined field of action (e.g. forest/urban area) and/or a moving object (e.g. map, compass). Orientation ability as a coordinative ability has little or no relevance in orienteering.
- Differentiation ability:
the ability to finely tune movements and body-parts movements, which is expressed in great precision of movement and movement economics. This has importance in orienteering in particular for the different soil conditions and vegetation influences, running uphill and downhill, in the thicket, with different sized obstacles.
- Rhythmic ability:
it is the ability to motorically reproduce an external given rhythm and to realize the "internalized" rhythm of a movement in the movement activity existing in one's own imagination. Running is basically a rhythmic sport. In orienteering, the running rhythm is constantly disturbed by the uneven forest floor/surface. A quick resynchronization of the rhythm after such disturbances makes it possible for the runner to achieve the highest efficiency in running.
- Responsive ability:
responsiveness is the ability to quickly initiate and perform appropriate short-term motor actions on a signal. It is important to react at the most appropriate time and with the task-adequate speed. In orienteering, athletes are constantly confronted with visual signals (sudden obstacles such as slippery trees or marshes, animals, other runners, cars, spectators etc.) that require rapid response.
- Transition ability:
transition is the ability to adapt to new circumstances or to continue the action in a completely different way, during the course of an action, due to perceived or anticipated changes in the situation. This means being able to cope well with the constant changes in soil conditions and the topography in downhill and mountain running in orienteering (weather, snow/ice on ground).
- Tying ability:
tying ability is the ability to properly coordinate partial body movements of the extremities, trunk and head with each other and in relation to the total body movement directed towards a specific action goal. In addition to arm and leg coordination under the specific conditions of orienteering, holding of map and compass, but also other auxiliary utensils such as chip and control description holder are to be considered here.

Summary:
basically, the running technique in orienteering on roads and paths is very similar to the one on track. When cross-country running in the forest, however, special things are placed to be considered about the running technique:

- When the ground is not seen, one must always "seek" the imprints of the forerunners

- Due to the rough terrain, the core muscles must ensure/optimize the forward movement of the center of gravity
- Carrying the map and compass and looking at the map during the run "affects" the running style

Summary

Performance determining factors

Because the orienteer runs around and above the anaerobic threshold without allowing the lactate to build up significantly, aerobic endurance performance determines the outcome. The energy supply is therefore primarily via glycogen, at long distances (90 minutes) also on aerobic fat burning.

While running stretches happen especially to the legs, so calves and ankles are determining the performance. Here, in many situations, a great use of force is crucial: the power should be sufficient over the entire competition (strength endurance).

Balance, skill and a sense of the best way through the terrain are critical to success. It is important to always find optimal routes in different types of forests.

Power muscles:

- Thigh (front)
- Glutes
- Back muscles
- Calf muscles
- Muscles to stabilize the ankles
- Thigh (back)
- Abdominal muscles
- Adductors, abductors
- Lateral support chains

Load peaks on athlete's body:

- Load peaks occur during downhill running (eccentric loads).
- Often deep ditches/trenches must be overcome. When approaching a ditch, the athlete must jump in time to the opposite side of the slope and reach the trench shoulder with strength. Most of the jump is done with one leg and when landing on the opposite side a high load occurs. Climbing the opposite slope side is usually done with a kind of load that corresponds to a one-leg squat.
- The ankles are heavily impacted when walking on forest surfaces (wood/stones) with some inclined foot positions, or forward compression of the foot. Running with spikes gives often better grip and higher possible force to the ground.
- For longer climbs, the highest endurance requirements are met. Here is often anaerobic run. In these situations, it is important to maintain the concentration. Often errors occur at the following control.

Energetic supply:

- aerobic energy supply at the anaerobic threshold
- anaerobic energy supply (up to 8 mmol/l) in intermediate phases, lactate is already degraded during the competition

Orienteering technique - development stages

Regardless of the age at which orienteering is started, the steps in the following plan can be followed with exercises and trainings derived from them.

3rd level: O as an elite performance sport	Step by step, level by level	Acting in duels and relay situations Optimize control and control location work Analyze partial routes Identify routes, assess, compare, route test, analyze steep sections Apply and compare different compass techniques Map reading: improve map memory and terrain reading
2nd level: O as a competitive sport	12 11 10 9 8 7	Read and note elevation contours in detail Interception based on terrain forms Fine orientation on short sections Run longer route choices, keeping to the direction (compass on compass) Identify easy route choices Run to catching features and linear objects
1st level: O as an adventure sport	6 5 4 3 2 1	Understanding contours, recognizing and observing typical, distinctive terrain forms Recognizing and using shortcuts: run routes on the shortest distance Get to objects from a nearby path, choose a direction from the map Navigate yourself from path to path. Make multiple decisions Run an easy way orienteering (guideline). Apply thumb handle, make decision Know the colors and objects of the orienteering map, hold the map with hands
Basic level: to be able to move in the forest, to understand easy courses, maps and symbols		

Possible training forms at a higher level are:

- Classic O-interval: speed above competition speed, highly demanding in terms of technique, because decisions must be taken quickly and accurately (reduction to the essentials).

Duration: variable from 3x15min to 8x4min

Possible training forms:

  - o Individual intervals
  - o Relay intervals (forked course) with different starting procedures: mass start, hunting start, group hunts for leader, couple start, ...
  - o Group intervals – unspecified

- Sprint intervals: to train for sprint events, especially throughout the winter (change to pure running interval training as well)
- Climb-intervals: approx. 3min uphill without map - down course 6-10min, approx. 3-4 times
- Indoor-intervals: mapped gym with equipment. Run different rounds in any order.

Variant: with Sport Ident stations on the ground

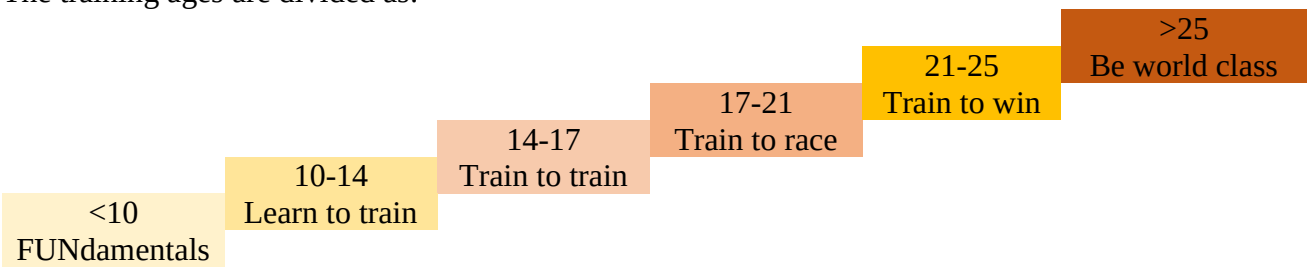
Training load in different ages *(International Orienteering Federation study)*

Number of workouts / age	15 y	16 y	17 y	18 y	19 y	20 y	21 y	22 y	23 y	24+
Total TE / year	377	399	416	444	511	545	575	584	595	609
Total TE / week	7,3	7,7	8,0	8,5	9,8	10,5	11,1	11,2	11,4	11,7

Number of training hours / age	15 y	16 y	17 y	18 y	19 y	20 y	21 y	22 y	23 y	24+
Training hours / year	260	312	365	415	468	520	556	606	655	704
Training hours / week	5,0	6,0	7,0	8,0	9,0	10,0	10,7	11,7	12,6	13,5

Creation of Seasonal and Weekly Training Plans

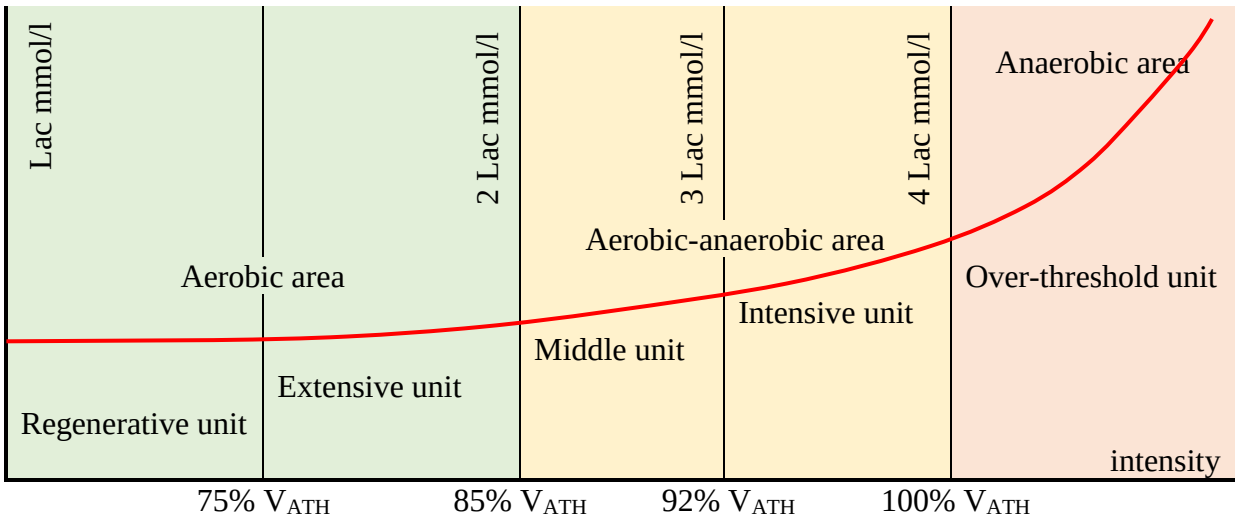
What should I train? How much should I workout? Why should I train this or that? These questions not only confront athletes in orienteering, but also the many dedicated coaches of the sport. Coaches should be able to create age-adequate training plans relatively simply, even without deep knowledge of sports science, regarding the individual season training plan (STP) and weekly training plan (WTP).
The training ages are divided as:



Long-Term Athlete Development Stages arranged to orienteering

Basic considerations for the creation of STPs and WTPs:

- First increase the number of training sessions, then increase the training period
- The number of training sessions per week appears to be relatively high at first glance in adolescence. But since the units are mostly kept short, there is no risk of overtraining
- A 3-1 periodization is commonly planned (3 weeks increasing load - 1 week regeneration)
- A basic amount of intensive units is also required in adolescence
- Compensation training is considered necessary at all ages
- Consider training intensity areas
- Intensity areas used in the WTP:
  - o COMP training (compensation): entry/exit at a control, active break in interval training ...
  - o basic endurance 1 (BET1) corresponds to the aerobic area
  - o basic endurance 2 (BET2) corresponds to the aerobic-anaerobic transition zone
  - o competition-specific endurance training (CET) corresponds to the anaerobic area
- The importance of performance tests for training zone determination should be noted
- Equally important to the importance of regular sports medical examinations
- 1x / week: training with an athletic club is recommended (coordination, running tech., plyo.)
- Practice of other sports for basic skills development, especially in the FMS develop. period for coordination, speed and agility.
- Strength training:
  - o with own body weight: to be built already during the adolescence. Due to the many sedentary activities, strength training is useful to prevent postural damage and to develop running core stability. As far as possible, exercises should be performed in the full range of motion.
  - o with weights: several years of construction or preparation are necessary. This should be started after completion of the growth phase. Correctly performed free exercises are preferable to exercises on equipment, as it trains entire muscle chains (intermuscular training - interplay of multiple muscles) instead of isolated muscles.



: lactate curve
V_{ATH} : speed at the anaerobic threshold

Intensity areas in orienteering with specification of the training unit in its intensity range.

Explanations of Season Training Plans

Each training session is assigned to only one training method at a time. For example, Hall training may include: intensive interval training + coordination + strength training + games. However, only one training session is booked in the Basic Training Plan (STP). The training is assigned to the method that the training mainly aims to.

Intensity ranges:
It is recommended to have a performance diagnosis regularly (at least 1x/year) in order to derive the training heart rate (pulse). Especially in the youth and junior area, there are big changes over time.

	CET Training	BET 2 Training	SET 2 Training	BET 1 Training	SET 1 Training	COMP Training
Target	Expression of the competition specific endurance ability	Development of basic endurance ability. Increase the aerobic / anaerobic performance	Increase the aerobic / anaerobic strength endurance ability	Stabilization and development of basic endurance ability. Increase the aerobic performance	Development and stabilization of aerobic strength endurance ability	Support the restoration. Increase the load capacity for subsequent intensive training
Method	Race-mode	Extensive interval-method	Intensive interval-method	Duration method	Duration method	Shorter duration method
	Intensive interval-method	Fartlek method	Repeat method	Fartlek method	Changeable permanent method	
	Repeat method	Changeable permanent method	Fartlek method		Extensive interval-method	
Intensity	High to really high	Medium high	High	Medium low	Middle	Very low

	Lactate over 6,0 mmol/l	Lactate 3,0 – 6,0 mmol/l	Lactate 4,0 – 7,0 mmol/l	Lactate 1,5 – 2,5 mmol/l	Lactate 2,0 – 3,0 mmol/l	Lactate below 2,0 mmol/l
	HR > 90% of HR max	HR 80-90% of HR max	HR 75-95% of HR max	HR 65-80% of HR max	HR 75-85% of HR max	HR 60-70% of HR max
	COMP: regeneration and compensation training BET: basic endurance training CET: competition-specific endurance training SET: strength endurance training					

Summary of goals, methods and intensities for training in endurance sports training areas.

Season training plans

Period: division of the year into the general preparation period (PP), the special preparation period (SP), the competition period (CP) and the transition period (TP). If a multiple cyclization is the case (say 2 seasonal peaks with, for example, European Champs and World Champs, or spring and fall seasons), then there are two competition periods, but also two special preparation periods and possibly two transitional periods. One macrocycle = PP + SP + CP + TP

Stages: belongs to the group of periodization. We have chosen the classic 3 + 1 periodization here. 3 + 1 means: 3 weeks increasing load, followed by 1 week of regeneration with less load (about 60-70% of week 3), both in scope and intensity.

Period contents: this field shows which abilities and skills should be trained more.
Ability = something innate, for example basic stamina (we are all capable of running)
Skill = something learned, for example compass bearing

Methods: here are training methods, so how the training is called, if is intended to improve the skills and abilities.

Competitions:

Category: international, national or regional

Type: name of the competition

Tr.-effort [trainings/week]: it is automatically filled by Excel. Corresponds to the number of units entered under Training Method below in the table.

Training Method:

Aerobic: lactate up to 2mmol/l blood. NOTE: the 2mmol/l and 4mmol/l sleepers are not carved in stone. They are generally accepted thresholds for the aerobic and anaerobic threshold. Metabolism is aerobic on the road, as long as the energy supply is mainly on fat acids (fat metabolism training). The pace is too high as soon as you cannot talk easily. Corresponds to the BET-1 range.

Mixed: from approx. 2 to 4 mmol/l lactate. The closer one gets to the anaerobic threshold, the more carbohydrates are used in the metabolic process. Corresponds to the BET-2 range.

Anaerobic: over 4 mmol/l lactate. Energy is provided via the 'fast' oxygen-intake process. Corresponds to the BET-2 to CET range.

R short (<45min): relaxed endurance runs under the aerobic threshold up to 45 minutes. Tip: nevertheless, the pace varies between runs and also runs just below the aerobic threshold (= faster slower endurance run)

R medium (45-75min): like R short, only longer

R long (>75min): like R medium, only over 75min

O easy: low-intensity orienteering technique training, BET-1 range

R fast: extensive endurance, BET-2 range

Extensive play: as with the alternating speed and interval method, the pace or the item is arranged here, but this is done later, depending on the terrain: uphill more intense, downhill easy, flat medium fast. BET-1 and BET-2 area

Alternate speed: alternately BET-1 and GBET-2 loads that are approximately the same length

Extensive intervals: e.g. 6x5min BET-2, with 1min break. Burden much longer than the recovery. But not above the anaerobic threshold!

O fast: orienteering training (interval or continuous method). Load up to the anaerobic threshold. Here are registered also the competitions. In the competitions, of course, there are peak loads above the anaerobic threshold, but on average they are run at the anaerobic threshold.

Intense play: see extensive play, CET category instead of BET-2

Intensive intervals: in comparison to extensive interval training, exercise intensity is increased (CET instead of BET-2), but the recovery time is increased in order to be able to perform the following exercise at the same level. For example, 10x400m. with 3min break. Lactate over 4 mmol/l or a classic H.I.T. training: 4x4min with 3min break. However, care must be taken to install 400m. intervals, as this is an extremely lactic acid training.

Long hill run (intervals): uphill fast and easy back. Located in the anaerobic area, because the local lactate concentration is expected to be well above 4mmol/l. For example, 6x4min uphill, 3-4min down easily (depending on how long you need).

Fast / CET: speed runs / repeat runs: maximum speed in each repetition. Long break. For example, 4x400m full speed with 10min break.

Sprint intervals: e.g. 3x10x15”/15”, short maximal exercise (15 sec) and short break (15 sec), 10 repetitions, 3 rounds, 3min series break.

Short hill run (intervals): short steep uphill sprinting (up to 1 minute), very easy down, 10-20 repetitions. Above the anaerobic threshold.

Games: school sports, ball sport.

Coordination: it can be used as the main training content. If it is planned as an independent unit (for example, in the morning or in the evening), it will be entered here. For example, Slackline, Pezziball, foot coordination (ankle gymnastics)

Specific strength: strength training to increase the effectiveness of running aspect. Strength exercises by e.g. faster / longer walk uphill. The transmission capacity of the force is crucial!

General strength: strength training aimed at raising or maintaining our general level of posture. For example, Hull strength training (sport-independent force of all muscles) also serves to prevent injury.

Practical guidance

Athletes need to improve running speed and orienteering technique at a similar progression, so to avoid being too fast with poor thinking or too good technically but too low speed.
Orienteering technique can be properly practiced and taught approximately from 10-12 years old.

It follows a list of activities that can be introduced and trained from that certain age.

	General preparation	Special period	Competition period
10-12 y/o	Light school activity Orienteering technical training (with warm-up and cool down) Light athletic training (focus on coordination) Other activities (skiing / skating) Total minutes: 390	Light school activity Orienteering technical training (with warm-up and cool down) Light athletic training Other activities (ergometer or MTB) Total minutes: 360	Light school activity Orienteering specific training Light athletic training (sprints) Competitions Total minutes: 300
12-14 y/o	Endurance run (medium or short - on road/track with O-work) Short run at the end of the light athletic training Core strength exercises Total minutes: 450	Endurance run (medium or short - on road/track with O-work) Light athletic training (focus on coordination and plyometrics) Short intervals Core strength exercises Total minutes: 420	Endurance run medium (on road/track with O-work, route choice exercise) Light athletic training (running technique, coordination, steps) Interval-Training 12x200m, 1:30min rest Total minutes: 340
14-16 y/o	Intensive school activity Bike or mixing unit Total minutes: 540	Intensive school activity Cross-country skiing or cycling Long jogging Total minutes: 560	Hill intervals short 2x10x30m uphill Short run on race-day morning Total minutes: 450
16-18 y/o	Hall Training (Pilates, Games) Power, 2-3 series, 10-12 WH, swimming Intervals: 6x200 / 5x1000 Strength, 2-3 series, 10-12 WH Ergo after endurance training Total minutes: 680	Strength (2-3 series, 10-12 WH) Focus on legs / trunk Swimming Early morning run Total minutes: 680	Strength (1 serie, 10-12 WH) Focus on legs / trunk Intervals 6 * 400m in 70 "(2'P) + 4 + 800m in 160 " (3 'P) DL short (with 5x run ABC + increase runs) Total minutes: 550
18-20 y/o	Short run intervals 15EL-15LS-3x15x30 "(30") - 20AL Intermedium RK 3 DG 120' run or 120'+ ski Alternative: 45' Ergo Strength Training 3 sets (10-8-8) Jumps, well warmed up 4 x 10 jumps (variants) Total minutes: 820	Short-run intervals 15'EL-15'LS-2x 30x30 "(30") - 20'AL Intermedium RK 3 DG Club interval 7 x 4' 15'L-15'LS-2x4x1000m in 2:54 (3-4 ') - 15'AL Total minutes: 900	Alternative training 45' Ergo Core strengthening 2 DG OL intervals 2x4-5 'OL + 6-8x200m in 31 " Gymnastics ball training Total minutes: 630
20+ y/o	Threshold 5-6 x 1800 m in 5:51 Core strengthening 2 DG MA: TheraBand, Gymnastics, Ankle and back reinforce, Sensomotoric Total minutes: 1110	Core strengthening 2 DG Alternative: 30' Ergo MA: TheraBand, Gymnastics, Ankle and back reinforce, Sensomotoric Total minutes: 990	MA: TheraBand, Gymnastics, Ankle and back reinforce, Sensomotoric Total minutes: 680

Attachments:

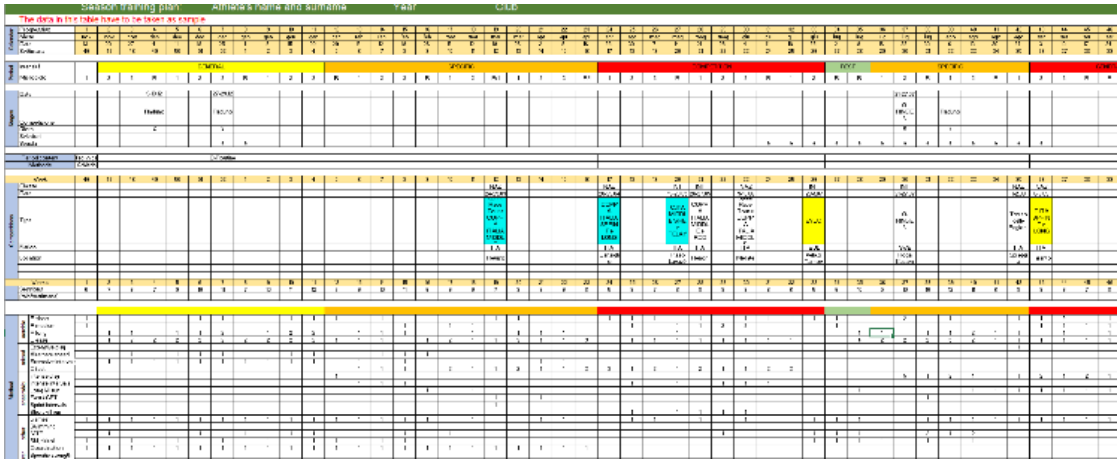
Attachment 1.
Desired running limits on 5000m as part of the track test:

	M	W
A-	15:15	18:10
B- /U23	15:45	11:05
B- (21/22)	16:10	19:10

Desired running limits on 3000m:

	M	W
20 y	9:30	10:50
19 y	9:45	11:05
18 y	10:10	11:20
17 y	10:15	11:35
16 y	10:35	11:55
15 y	10:55	12:15
14 y	11:15	12:35

Attachment 2: Season training plan.xlsx



Attachment 3: Weekly training plan.xlsx

15 y/o

Date	Topic	Note	Training area					
Period	*General preparation period 1*		COMP	BET1	BET2	CET	Other	Stren.
MON January	Endurance run medium	On road/track with O-work		60				
TUE	Light school activity			30				
	Orienteering technical training			40				
WED	Endurance run medium			50				
THU	Light athletic training	Focus on coordination	10				30	
	Endurance run short	After previous training		30				
FRI	Light school activity						30	
SAT	Orienteering training (fast)	With warm-up and cool down	20		30			
SUN	Skiing / Skating			60				
	Total minutes in the week	390	30	270	30	0	60	0
Week XX	Total according to annual plan	390						