Canadian Sport Centre Pacific

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PERFORMANCE POINT

PERFORMANCE PLANNING

QUANTIFYING THE YTP — MODELLING AND MONITORING THE TRAINING LOAD

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One aspect of the training plan that many coaches struggle with is quantifying the training loads throughout an annual cycle. Table 1 below outlines both the benefits and challenges of planning and monitoring volume and intensity. By modelling the training plan the coach creates a "roadmap" that is sign-posted by things like fatigue, recovery, intensification, and load. The journey down the training road is then monitored to provide feedback to the coach and athlete on the training response where adaptation, regeneration and training stimulus can be factored into subsequent mesocycles (eg. 4 weeks).

Best practice would suggest that many experienced coaches really only quantify the training plan one mesocycle at a time. This said, modelling the training load throughout the year is advantageous for peak performance and finding optimal training conditions based on the yearly calendar[1].

Simon Whitfield, Triathlon. PHOTO: Triathlon Canada

Table 1

ADVANTAGES	CHALLENGES
Periodized training assists in creating optimal stimulus and recovery	Volumes and intensities will fluctuate within every week
Informs total amount of training including sport specific practice, conditioning and other training.	Quantification of training plan will change depending on athlete adaptation to training
Provides a model that can show windows of optimal training throughout a year	Individualizing training volume and intensity for groups of athletes

DEFINING VOLUME INTENSITY AND LOAD

In order to help determine the modelled training it is important to define the different characteristic for quantifying the training plan. These include volume, frequency, intensity and load. Table 2 identifies some of the key elements used to quantify training in the yearly training plan.

See following page for Table 2.

Table 2

TERM	DEFINITION AND CONSIDERATIONS
Load	Load is the combination of Intensity, Volume and Frequency. One principle in periodization is block loading where training loads progressively increase over 2 to 4 weeks with a recovery week where the training load is decreased.[2] (See figure 1. – green bars)
Frequency	Frequency is the number of training sessions. In most annual plans the frequency of training will usually be the number of sessions in a given week or microcycle.
Volume	Volume is the total duration of training. Typically the training volume in the annual plan includes frequency in order to calculate the weekly (microcycle) volume. More specifically training volume can be measured within a training session as the product of the number of sets multiplied by the number of repetitions. It is best to try to be as specific as possible when measuring volume which is difficult over a microcyle if there are multiple types of training. (EG. Running distance versus strength training). Hence the total training time is used by many coaches to determine the training volume. (See figure 1.– blue line)
Intensity	Intensity is the effort that is required during the training. In the modelled annual training plan intensity is at best a guess of the average exertion during the microcyle (training week). While training intensity can be accurately measured by heart rate or resistance (eg. power output), it is difficult to accurately quantify the total intensity of a given session let alone a week of training. (See figure 1. – red line) Hence, intensity could be quantified as an athlete's perception of "how hard" they worked in a training session and can be measured by asking the athlete's RPE (rate of perceived exertion).

MODELLING THE TRAINING – RELATIVE VOLUME AND INTENSITY

Perhaps the easiest way to model the training year is to identify the relative percentage based on training maximums, whether based on the highest total training (volume), or the week with the greatest magnitude of competition (intensity). The table below identifies a method for calculating modelled training. (See text box below on Page 5 for Team Sport solutions)

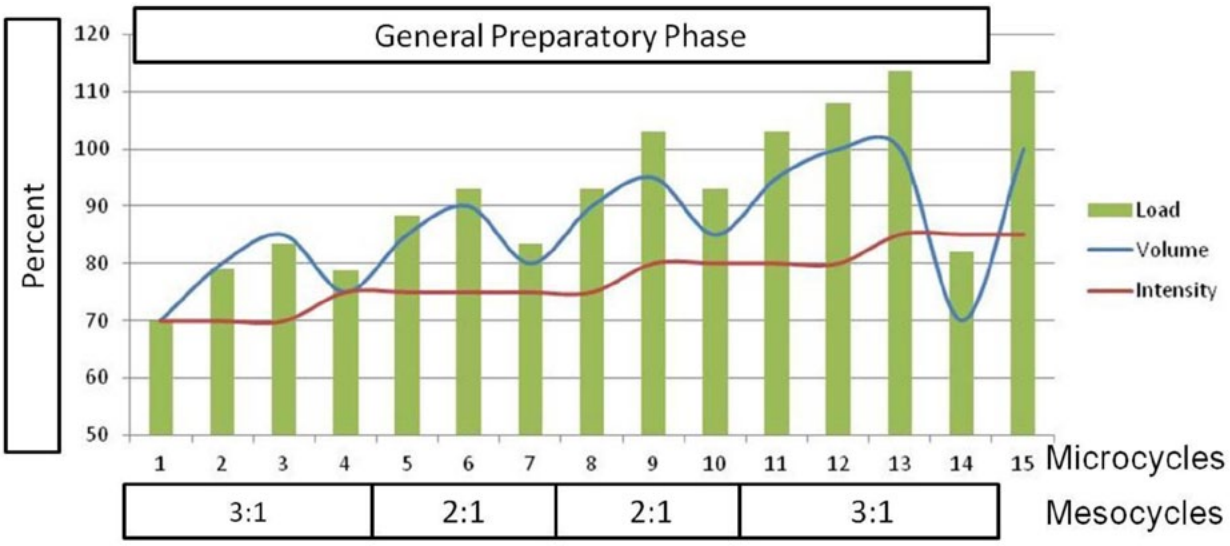
Table 3: Calculating the modelled training volume, intensity and load

Modelled Volume		Modelled Intensity	
Hours in Greatest Training week	16 hours = 100%	Greatest Magnitude Week.	Peak competition = 100%
Example Modelling (calculations)	100% = 16 x 1.0 = 16 hr 87.5% = 16 x 0.9 = 14 hr 75% = 16 x 0.75 = 12 hr 50% = 16 x 0.5 = 8 hrs	Example Modelling (Calculations)	100% = Highest Prioritized competition 110% = Simulation week 90% = Hard Training 70% = Lowest Training Intensity 50% = Rest week

Training Load			
Load Index = Total Hours x relative intensity/10			
Description of Training	Volume	Intensity	Load Units
High Volume Week	15 hours	75% / 10	112.5
Peak Competition Week	8 hours	100% / 10	80
High Intensity Week	10 hours	95% / 10	95

The method described in Table 3 allows the coach to easily model a training year where relative percentages can be put into a spreadsheet and generate a graph depicting the training (See figure 1).

Figure 1: Example modelled training volume, intensity and load



MONITORING THE TRAINING - TRIMP

Whether in team or individual sports it is absolutely essential to monitor the actual training in order to make adjustments to the ongoing plan. One method of doing this is through TRIMP scores, a method created for monitoring TRaining IMPulses. This method has been validated in studies examining the relationship of perceived versus actual training intensities, and when combined with training volume, is a useful predictor of actual training load[4,5]. The method for using TRIMP scores is described in Table 5.

TRIMP INSTRUCTIONS

Table 5: TRIMP Scoring instructions [5]

RPE Rating	Descriptor	INSTRUCTIONS: From best of memory (as close to after training session), give each training session a rating of perceived exertion (RPE) rating on how hard you felt the entire session was. This includes warm-up and cooldown, etc. For example, perhaps normally, a 60min easy run/practice would be scored a 2, but on a certain day you were feeling horrible for that run/practice, so you might score a 4 Or, for example, you might do a very intense 30min weight session, which you score an 8.. Or, perhaps, your 90min session, including 4 x 1 mile repeats, might get a 9, as you really went for it. Do not take a long time scoring the session, just go on your gut instinct.
0	Rest	
1	Very very easy	
2	Easy	
3	Moderate	
4	Somewhat hard	
5	Hard	
6	Harder	
7	Very Hard	
8	Intense	
9	Very intense	
10	Maximal	

CALCULATING TRIMP EXAMPLE

The example below would be based on a modelled week where the expected training volume is 12 hours and the relative intensity is high (80%+). The training load is monitored per session by multiplying the rate of perceived exertion by the number of training minutes. This will provide a measure of Training Impulse Units for the actual week. In order to compare this to an actual training load in the model plan, TRIMP Units can be divided by 50 to provide a relative comparison to the planned training load. In order assist with ongoing monitoring, the use of athlete training logs is critical. This information can then be summarized and inputted back into the YTP.

Table 6: Example calculation of TRIMP scores related to modelled load units

Day	Type of Training	Time (A)	RPE (B)	TRIMP Unit (A x B)	Load Units TU / 50
Monday AM	OFF				
Monday PM	Practice	90 min	8	720	15.4
Tuesday AM	Weights	60 min	5	300	6
Tuesday PM	Conditioning	30 min	7	210	4.2
Wednesday AM	OFF			0	0
Wednesday PM	Practice	90 min	7	630	12.6
Thursday AM	Weights	60 min	5	300	6
Thursday PM	Practice	90 min	10	900	18
Friday AM	Conditioning	30 min	3	90	1.8
Friday PM	Practice	90 min	3	180	3.6
Saturday AM	OFF			0	0
Saturday PM	Practice / Game	120 min	10	1200	24
Sunday	Hydro Therapy	60 min	3	180	3.6
		12 Hours		4710	95.2

SUMMARY

By modelling and monitoring the training plan, the coach is able to understand all aspects of training that will affect optimal athlete performance. Furthermore, by monitoring training using TRIMP scores the coach can further individualize training and help the athlete assess gaps between planned and actual training loads.

VIDEO TUTORIAL – QUANTIFYING THE YEARLY TRAINING PLAN

The following thumbnails below are short video tutorials that will help you to quantify and create a modelled graph in you excel template YTP. Click through the series for more information.

[Video 1 – Introduction – Using Excel]
[Video 2 – Setting up the planning template]
[Video 3 – Creating formulas]
[Video 4 – Creating a Graph]
[Video 5 – Modifying the Graph]
[Video 6 – Modelling the plan]

References

[1] Norris, S.R. & Smith, D.J. (2002) Planning, periodization, and sequencing of training and competition: The rationale for a competently planned, optimally executed training and competition program, supported by amultidisciplinary team. In M. Kellmann (Ed.), Enhancing recovery: Preventing underperformance in athletes (pp. 121- 141). Champaign, IL: Human Kinetics.

[2]Smith, David J. (2003) A Framework for Understanding the Training Process Leading to Elite Performance; Sports Med; 33 (15): 1103-1126

[3]Manzi, V; Iellamo, F; Impellizzer, F; D'Ottavio, S; Castagna, C. (2009) Relation between Individualized TrainingImpulses and Performance in Distance Runners. Medicine and Science in Sports and Exercise: Medicine & Science in Sports & Exercise. 41(11):2090-2096, November 2009.

[4]Foster, C; Florhaug, J; Franklin, L G; Hrovatin, L.A.; Parker, P.D.; Dodge, C (2001) A New Approach to Monitoring Exercise Training: Journal of Strength and Conditioning Research: 15(1), 109-115.

[5]Trent Stellingwerff (2012), Template notes. Canadian Sport Centre Pacific.

INDIVIDUALIZED PLAN – TEAM SPORT SOLUTIONS

Certainly the more objectively based the sport (swimming, rowing etc.), the easier it is to accurately model training volume, intensities and load. This said, the method described in this performance point may be relevant in team sports where there is a combination of sport-specific practices monitored by the coach and supplemental training which may be done independently by the athlete. In this circumstance the coach may be able to model the training volume based on a combination of sport specific practice and supplemental training (conditioning). For example, a training week with a volume of 75% based on a maximum 16 hours of training (12 hrs) can be allocated to sport specific training (7.25 hrs) which could include 3 practices (1.75 hrs) and 1 game (2 hrs). The remaining time (4.75 hrs) could be allocated to supplemental training and could include 3 strength sessions (1 hrs) and other 2 training sessions (50 mins) of general conditioning or recovery training (i.e. hydrotherapy). Hence, in this example the ratio of sport specific to supplemental training would be 60% to 40%.

When determining sport-specific intensity, many team sport coaches are able to adjust the practice design in order to elicit higher or lower intensities of training. The table below identifies some descriptors of low, medium and high intensity training which coaches can use as a template for designing different training sessions depending modelled intensity in the YTP.

Table 4: Factoring intensity into team sport training models

FACTOR	LOW INTENSITY (<4 RPE)	MEDIUM INTENSITY (5-7 RPE)	HIGH ITENSITY (8-10 RPE)
Scrimmage	Un-Opposed	Semi-Opposed	Fully Opposed
Contact	None	Mod (Player-Ground)	Full (Player - Player)
Speed of Execution	Slow (Walk)	Moderate (Jog)	Fast (Sprint)
Skill Complexity	One	2-3	>4
# of Decisions	One	Few	Many
PERCENT	50-70%	70-90%	90 + %

To some degree the combination of sport-specific and supplemental training activities may assist the team sport coach in individualizing the training plan by prescribing individualized microcycle plans for each athlete based on the overall modelled volume and intensity.