

**Sports Technology in teaching PE - PENZ Conference 2010**

Case Study & Discussion document – Secondary School Rugby Union.

This case study involved two secondary school rugby squads. In the interest of player privacy and with the season still in full swing, names have not been disclosed and a sample of athletes have been used. In each of the two teams, 8 athletes were measured from the positional groups of:

- tight forwards
- loose forwards
- inside backs
- outside backs

Each athlete wore a VXSport log and atleast half of the group in each session also wore a heart rate monitor. Information was collected from one training session and one match for both teams.

The below is an overview of information collected for discussion at the 2010 PENZ conference.

**TRAINING REPORT**



Athlete Name	Team Name	Date	Duration (minutes)	Distance (m)	Avg Speed (km/h)	Max Speed (km/h)	Avg HR (bpm)	Max HR (bpm)	EC (Calories)	Work/Recovery
	Secondary Schoo	2010-04-27	57	2,141	3.70	21.70	123	182	225	1:1
	Secondary Schoo	2010-04-27	105	8,182	4.70	27.60	134	171	725	3:2
	Secondary Schoo	2010-04-27	106	7,675	4.40	28.00	143	165	725	1:1
	Secondary Schoo	2010-04-27	105	6,953	4.00	22.10	148	187	850	3:2
	Secondary Schoo	2010-04-27	106	7,381	4.30	27.30	146	192	875	1:1

Training Session time: Avg. 106 minutes. Skills and Fitness. >>> Game Avg. Total file 165min

Training Distance covered: 5.7km – 8.2km >>> Total Game Day distance 10-11km

Training Avg. HR: 123-148 >>> Game day 145-160

Training Max. HR: 165-192 >>> Game day 185-205

Training Work/Recovery Ratio: Avg. 1:1 >>> was the same in the game. A very positive thing.

Training Energy Consumption: 725-875 >>> Game day 1300-1600

Training RPE Coach: 7 and a 6 in relation to game specific. Game day RPE Coach: 5.

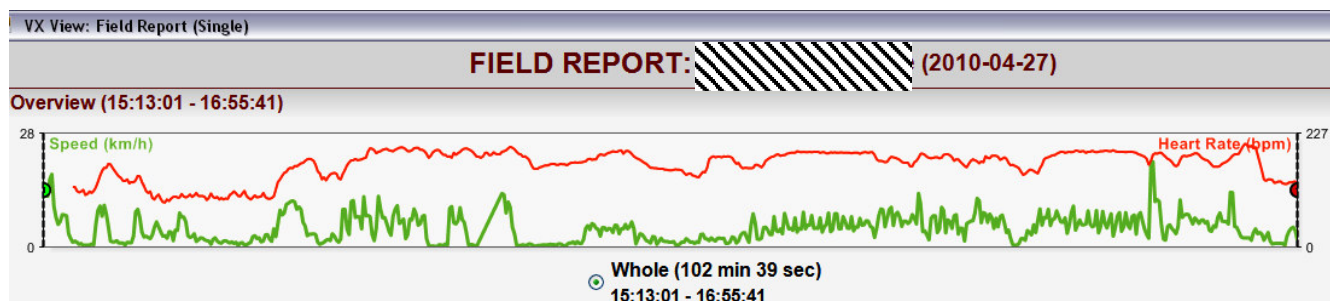
Training RPE Athlete: 8 and a 7 in relation to game specific. Game day RPE Athlete: 7.

Numbers exclude athlete 1 – as full session not recorded.

Summary: Distance covered in the training session falls within the expected norm for a session of this nature, although I wouldn't have expected to see the difference in range of distance covered. For this reason this type of monitoring is advantageous to ensure athletes are covering similar training distances in relation to position specific fitness. VXSport is releasing a real time function later in the year which will allow teams to measure sessions and games and adjust athlete workloads accordingly at the time with preset alerts.

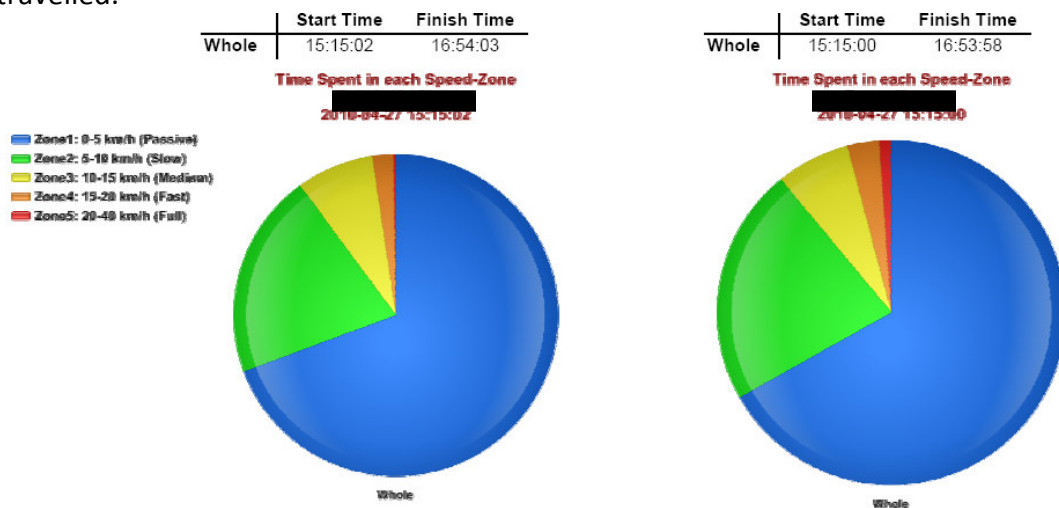
There was also a noticeable difference in avg. HR and max. HR. Without watching the entire session and knowing if athletes had different requirements, it could be said that some athletes were not working consistently as hard as others and I would personally be interested in any fitness testing benchmarks specific to the athletes in the above table and how these compare with match fitness.

Work/Recovery Ratios were inline with what we are currently seeing in Rugby Union training and games. The small differences in RPE are also worth noting in terms of coach expectations vs. athlete expectations. Below is a worm chart of the training session. You will be able to see from this how the skills and physical conditioning components of the session effected HR. Speed is in green – HR in red.

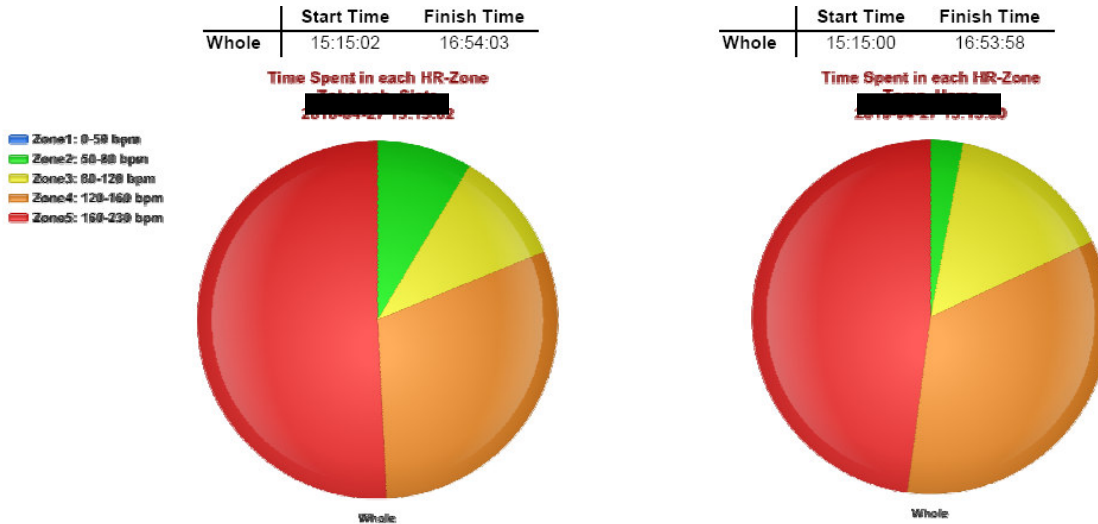


### Field Report – Comparison of Training between Player 4 and Player 5

The high component of zone 1+2 speed movement can be explained by the short sharp nature of this session, whereby the athlete did not have time to reach maximal speeds, however they were still working hard due to contact and conditioning drills. Generally we look for the distance covered over 10km/hr to provide an indication of running volumes, which in this case was 10% of the session time and 30% of the total distance travelled.



With regards to HR, approximately half the session time was spent in HR zone 5, be that above 160bpm and equated to more than 60% of the distance covered.



115-130 Sprints / Accelerations exceeding 10km/hr up to 27km/hr. This would correlate closely to match performance. However, there was a high component of sprints above 20m which exceeds the general norms of a game whereby sprints of 5-15m are more to be expected. The duration of these sprints were also high, which could be expected in the early parts of the season or pre season.

**SPRINTS: Distrbtn**

Speed (km/h)	Count
27	1
25	1
24	10
23	1
22	5
21	7
20	5
19	11
18	10
17	6
16	6
15	8
14	9
13	11
12	13
11	14
10	12

V's

**SPRINTS: Distrbtn**

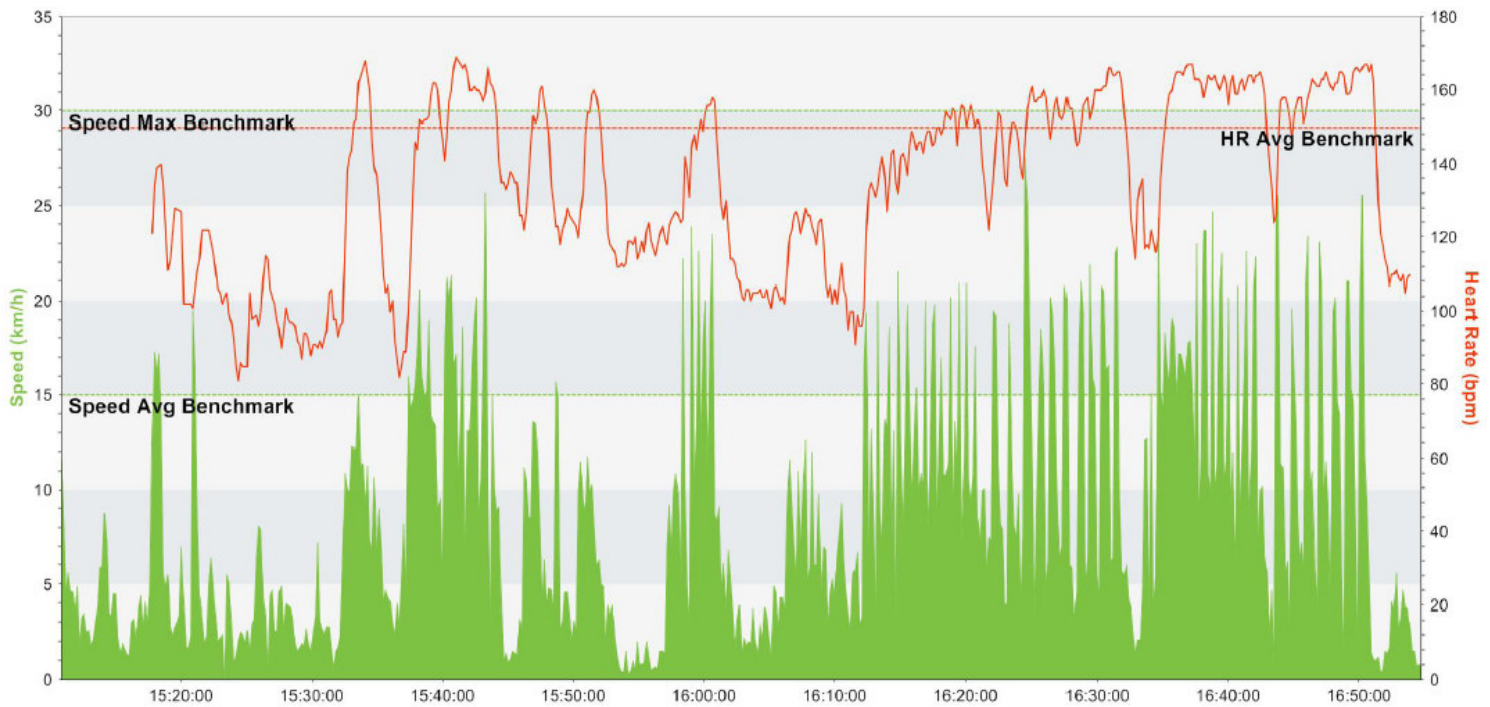
Speed (km/h)	Count
22	2
21	6
20	6
19	9
18	12
17	5
16	8
15	12
14	13
13	14
12	9
11	8
10	13

## Track Report – Training for Player 2

This type of report is useful when an individuals athlete benchmarks are used to monitor a session. The red line shows the HR rising and falling often in the first part of the session, to the point where a steady decrease in HR can be seen part way through the session. As the repeated speed part of the session begins, there is a clear correlation to HR. I often consider the time spent above 150bpm for HR and runs in excess of 15km/hr to be the most taxing on rugby players. That and the amount of contact (tackle, ruck etc) in a session or game which we do not currently track but will in due course.

### Speed Chart

Date	Start Time	Finish Time	Distance	Max Speed	Avg Speed	Max HR	Avg HR	Energy Consumption
2010-04-27	15:10:43	16:54:49	8.168 km	27.6 km/h	4.7 km/h	171 bpm	134 bpm	775 Calorie



## Field Report – Comparison of Training vs. Game for Player 6 (not included in training table)

In this report I have broken the training session down into 4 equal quarters. Within the game the quarters are as follows: Pre Warm Up, Warm Up, 1<sup>st</sup> Half and 2<sup>nd</sup> Half.

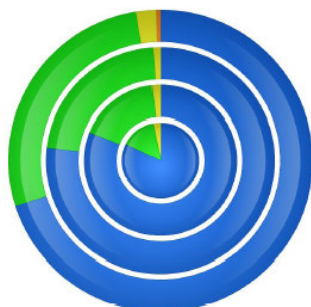
	Start Time	Finish Time
1Qtr	15:13:07	15:38:27
2Qtr	15:38:49	16:04:10
3Qtr	16:04:32	16:29:52
4Qtr	16:30:14	16:55:35

	Start Time	Finish Time
1Qtr	10:43:49	11:30:22
2Qtr	11:30:51	11:57:51
3Qtr	12:00:42	12:39:28
4Qtr	12:45:11	13:19:49

Time Spent in each Speed-Zone

2010-04-27 15:13:07

- Zone1: 0-5 km/h (Passive)
- Zone2: 5-10 km/h (Slow)
- Zone3: 10-15 km/h (Medium)
- Zone4: 15-20 km/h (Fast)
- Zone5: 20-40 km/h (Full)



1Qtr (inner)  
2Qtr  
3Qtr  
4Qtr (outer)

Time Spent in each Speed-Zone

2010-05-01 10:43:49



1Qtr (inner)  
2Qtr  
3Qtr  
4Qtr (outer)

A couple of observations here:

- 1) Game day file shows a higher component (significant) of speed related work. I can make more formal suggestions around this, but the obvious one is to include short bouts of repeated speed within skills sessions to accommodate this.
- 2) On game day 3-4km (which is high), was covered prior to the game. This was consistent across all the players who were monitored.
- 3) Player 6 had to work in the higher heart rate zones for longer periods of time on game day.
- 4) Warm Up would appear to have a good level of intensity, appropriate to the game, but at the same time perhaps cover too much distance. This can be discussed further.

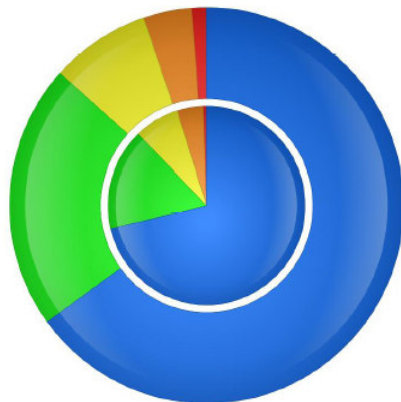
	Distance (m)	Max Speed (km/h)	Avg Speed (km/h)	Max HR (bpm)	Avg HR (bpm)	EC (Calories)	Distance (m)	Max Speed (km/h)	Avg Speed (km/h)	Max HR (bpm)	Avg HR (bpm)	EC (Calories)
1Qtr	1352	17.90	3.20	178	123	150	2,722.00	31.50	3.50	192	133	350
2Qtr	998	13.20	2.40	202	181	300	1,700.00	27.40	3.80	201	161	275
3Qtr	1454	13.20	3.40	193	175	275	3,241.00	30.80	5.00	204	176	450
4Qtr	1697	21.00	4.00	209	174	275	3,183.00	30.20	5.50	196	178	400
Whole	5501	21.00	3.20	209	163	1050	10,846.00	31.50	4.40	204	160	1475

\*EC: Energy Consumption

## Field Report – Game for Player 1

The attached report only shows game time. No warm up or the half time break was considered. The total distance covered was on the mid range of what would be expected by a No.7 – loose forward, such as shown here. Player 1 covered more distance in the second half, as the game may have opened up, but was required to work harder in the first half in terms of heart rate. That all said he completed over 130 short accelerations in the game itself which would be what would be expected in terms of position and this level of rugby. Sprint distances were upto 40m, but on average 10-20m.

- Zone1: 0-5 km/h (Passive)
- Zone2: 5-10 km/h (Slow)
- Zone3: 10-15 km/h (Medium)
- Zone4: 15-20 km/h (Fast)
- Zone5: 20-40 km/h (Full)



1Half (inner)  
2Half (outer)

- Zone1: 0-50 bpm
- Zone2: 50-80 bpm
- Zone3: 80-120 bpm
- Zone4: 120-160 bpm
- Zone5: 160-230 bpm



1Half (inner)  
2Half (outer)

### Speed-Zone Stats

		Zone 1	Zone 2	Zone 3	Zone 4	Zone 5
<b>Time</b>	<b>1Half</b>	71%	16%	7%	4%	1%
<b>(in Speed-Zone)</b>	<b>(mm:ss)</b>	(27:44)	(06:25)	(02:52)	(01:40)	(00:14)
	<b>2Half</b>	65%	22%	8%	4%	1%
		(22:59)	(07:38)	(02:54)	(01:24)	(00:26)
	<b>All</b>	68%	19%	8%	4%	1%
		(50:43)	(14:03)	(05:46)	(03:04)	(00:40)
<b>Distance</b>	<b>1Half</b>	34%	25%	21%	17%	3%
<b>(in Speed-Zone)</b>	<b>(m)</b>	(957)	(707)	(588)	(467)	(85)
	<b>2Half</b>	30%	29%	21%	14%	6%
		(867)	(836)	(588)	(403)	(157)
	<b>All</b>	32%	27%	21%	15%	4%
		(1824)	(1543)	(1176)	(870)	(242)
<b>Avg HR</b>	<b>1Half</b>	82%	84%	84%	83%	83%
<b>(in Speed-Zone)</b>	<b>(bpm)</b>	(164)	(168)	(168)	(166)	(166)
	<b>2Half</b>	81%	82%	82%	83%	83%
		(162)	(163)	(164)	(166)	(166)
	<b>All</b>	82%	82%	83%	83%	83%
		(163)	(165)	(166)	(166)	(166)

Time: Percentage of time spent in each HR zone

Avg HR: Average Heart Rate (percentage of athlete's max HR benchmark [Avg HR: Average Heart Rate (percentage of athlete's max HR

Benchmark: 200bpm)

NOTE: Totals may not sum to 100% due to rounding

**HR-Zone Stats**

		Zone 1	Zone 2	Zone 3	Zone 4	Zone 5
<b>Time</b>	<b>1Half</b>	0%	0%	0%	31%	69%
<b>(in HR-Zone)</b>	<b>(mm:ss)</b>	(00:00)	(00:00)	(00:00)	(12:08)	(26:46)
	<b>2Half</b>	0%	0%	0%	39%	61%
		(00:00)	(00:00)	(00:00)	(13:37)	(21:44)
	<b>All</b>	0%	0%	0%	35%	65%
		(00:00)	(00:00)	(00:00)	(25:45)	(48:30)
<b>Distance</b>	<b>1Half</b>	0%	0%	0%	26%	74%
<b>(in HR-Zone)</b>	<b>(m)</b>	(0)	(0)	(0)	(735)	(2069)
	<b>2Half</b>	0%	0%	0%	35%	65%
		(0)	(0)	(0)	(991)	(1860)
	<b>All</b>	0%	0%	0%	31%	69%
		(0)	(0)	(0)	(1726)	(3929)
<b>Avg Speed</b>	<b>1Half</b>	0	0	0	4	5
<b>(in HR-Zone)</b>	<b>2Half</b>	0	0	0	4	5
	<b>All</b>	0	0	0	4	5

Time: Percentage of time spent in each HR zone

Avg Speed: Average Speed (percentage of athlete's max Speed benchmark [Avg Speed: Average Speed in km/h])

NOTE: Totals may not sum to 100% due to rounding

**Distance Table**

	Distance (m)	Max Speed (km/h)	Avg Speed (km/h)	Max HR (bpm)	Avg HR (bpm)	EC* (Calories)
<b>1Half</b>	2804	26.50	4.30	186	165	400
<b>2Half</b>	2850	26.50	4.80	183	163	350
<b>Whole</b>	5654	26.50	4.50	186	164	775

\*EC: Energy Consumption

**SPRINTS: Top Speed**

Time (hh:mm:ss)	Max Speed (km/h)	Start Speed (km/h)	EndSpeed (km/h)	Avg Speed (km/h)	Distance (m)	Max Accel (m/s/s)	Avg Accel (m/s/s)	Duration (secs)
12:01:26	19.3	1.0	14.0	15.0	25	3.30	0.60	6.0
12:01:42	17.6	5.3	11.3	14.0	7	4.70	1.00	1.8
12:01:44	17.2	5.1	12.1	14.0	22	4.50	0.40	5.5
12:01:59	13.2	4.9	8.5	10.0	4	3.60	0.70	1.5
12:02:11	10.2	2.5	7.2	7.0	6	4.30	0.50	2.8
12:02:22	12.1	4.1	8.0	10.0	6	4.60	0.50	2.3
12:05:46	11.4	1.6	7.6	7.0	4	5.10	0.70	2.3
12:05:55	14.9	4.5	8.9	12.0	16	3.00	0.30	4.8
12:06:01	15.9	5.7	11.6	13.0	22	2.20	0.30	6.0
12:06:10	12.5	5.1	9.2	9.0	10	2.90	0.30	3.8
12:06:20	17.0	2.1	11.5	13.0	28	3.40	0.40	7.0
12:06:31	16.4	7.1	10.3	13.0	17	3.20	0.20	4.5
12:06:43	15.5	6.5	9.5	12.0	12	3.00	0.20	3.5
12:07:20	11.2	2.5	8.3	6.0	6	3.40	0.50	3.5
12:07:49	18.9	2.3	10.9	13.0	13	4.40	0.70	3.5
12:08:06	11.1	2.7	8.0	7.0	9	3.80	0.30	4.8
12:08:50	15.7	2.4	10.1	12.0	12	5.30	0.60	3.5
12:09:05	20.8	2.3	13.4	14.0	27	3.90	0.40	7.3
12:11:01	24.3	1.9	15.8	17.0	30	7.50	0.60	6.5
12:11:42	15.0	2.4	6.2	11.0	11	4.10	0.30	3.7
12:11:46	16.1	7.1	11.2	14.0	17	6.80	0.30	4.5
12:12:35	19.5	3.0	14.2	13.0	34	4.00	0.30	9.5
12:13:41	14.7	4.4	10.9	11.0	15	3.40	0.40	4.7
12:13:57	18.0	2.3	10.8	12.0	25	3.00	0.30	7.5
12:14:08	25.2	10.2	18.6	20.0	14	3.90	0.90	2.5
12:14:57	26.0	1.5	17.8	19.0	19	5.70	1.20	3.7
12:16:11	12.6	5.0	6.6	10.0	11	4.20	0.10	4.0
12:16:51	13.4	2.3	10.0	7.0	15	3.40	0.30	8.0
12:17:10	16.1	2.6	10.1	12.0	30	2.80	0.20	9.2

**SPRINTS: Distrbtn**

Speed (km/h)	Count
26	5
25	3
24	2
23	1
22	6
21	3
20	7
19	8
18	10
17	7
16	9
15	13
14	8
13	11
12	10
11	13
10	7

# Sample of sprints table between 12:01:26 – 12:17:10.

# Distribution table is complete for entire match

### Location Report – Game for Player 1

Included below are two location reports. One of the complete recording and the other for only the game period and only for speeds above 10km/hr. You will see the sprints are largely in the centre of the field, but regardless of this, the sprints rarely are in a straight line. Again a good piece of feedback when looking at repeated speed sessions, so to adjust high speed direction changes and starting positions.

