



## ANALYSIS OF COVERED DISTANCE BY PROFESSIONAL FOOTBALL PLAYERS IN BULGARIAN SECOND LEAGUE

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### ABSTRACT

Football is undoubtedly one of the most famous sport in the world. Monitoring covered distance during training process and official games is well used tool for controlling both fatigue level and sport realization. There is a lot of information for professional football players during world cups or international matches, but the data for the footballers in the lower leagues is fragmentary. There is no available information regarding distance covered in different speed zones for lower divisions in Bulgaria. The aim of the following study is to reveal actual data from Bulgarian Second League leading team. For the purpose of the study is used full set of Polar Team Pro GPS system with all option included. Based on collected data is made a profile of second football level football player and data from the matches can be used as basis for comparison. Also, we present evaluation tables for assessment of covered distance in all speed zones for football players in this league of the professional football in Bulgaria.

**Key words:** football, covered distance, GPS

### PURPOSE

The advent of modern technology is an irreversible process directly related to improving the level of performance in sport and football in particular (J. Paterno et al., 2002). A number of technologies available for direct use in sports practice find their place, both in training process and official matches (Buchheit, M., et. al., 2014). For example, we can point out software and hardware products for: tactical analysis, performance evaluation, and others. The systems for monitoring covered distance and some functional indicators based on GPS system are gaining special popularity (Rago, V., et. al., 2019). This type of systems is mandatory for professional football. And from there we have large amount of data for professional football players.

The second professional league consist of football teams which limited funding which restricts the use of

such system. In our opinion the revealing of such data will be great addition for sport theory and great interest among sport specialists in football.

The main aim of the following study is to obtain, analyze and present original data revealing covered distance in Second Professional football league in Bulgaria.

### METHODS

For solving the main aim of the study, we performed the following tasks:

1. Analysis of accessible scientific and methodological literature regarding studied theme.
2. Collection of research data and its summarization in a database.
3. Statistical processing and expert analysis of research data.
4. Development of control standards for cover distance in official matches valid for football players with similar sport qualification level.

For the purpose of the study, we analyze the performance of Professional Football club “CSKA 1948” Sofia (**Figure 1**), competing in Bulgarian

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Second League in season 2018/2019. In details we study the spring half season and all 13 official league matches played by the team (Table 1). In this season

the team had leading role in the Championship and finished on fourth position.



Figure 1. Official logo of Professional football club “CSKA 1948” Sofia.

To carry out the research we used GPS system Polar Team Pro in its full set (Figure 2 and 3), which was not only used in official matches but also during training session for monitoring not

only covered distance as total value but covered distance in different speed zones and heart rate performance and recovery periods.



Figure 2. Polar Team Pro docking station.



Figure 3. Polar Team Pro heart rate and GPS unit.

**Table 1.** PFC CSKA 1948 (Sofia) match program for spring season 2018/2019.

Match №	Date	Home team	Guest team	result	CSKA 1948 (win, draw, loss)
1	26.2.2019	CSKA 1948	Kariana (Erden)	2-1	win
2	4.3.2019	Montana	CSKA 1948	2-2	draw
3	8.3.2019	CSKA 1948	Stumska slava (Radomir)	3-0	win
4	17.3.2019	Ludogorets II (Razgrad)	CSKA 1948	0-1	win
5	1.4.2019	CSKA 1948	Litex (Lovech)	1-0	win
6	6.4.2019	Dobrudja (Dobrich)	CSKA 1948	0-0	draw
7	15.4.2019	CSKA 1948	Pirin (Blagoevgrad)	2-1	win
8	22.4.2019	Tsarsko selo (Sofia)	CSKA 1948	0-0	draw
9	30.4.2019	CSKA 1948	Nesebur	2-0	win
10	5.5.2019	Pomorie	CSKA 1948	1-2	win
11	10.5.2019	CSKA 1948	Lokomotiv (Gorna Oriahovitsa)	4-0	win
12	19.5.2019	Arda (Kurdzali)	CSKA 1948	1-0	loss
13	23.5.2019	CSKA 1948	Lokomotiv (Sofia)	3-1	win

## RESULTS

In total 18 field players (goalkeepers are excluded from the study) took part in the official spring half season 2018/2019. With starting lineups and substitutes there are in total 161 cases. The main core

of the team consists of 11 players with 10 or more played games with percentage played games ranging between 6,2 and 8,1 from all 161 studied cases – **Table 2.**

**Table 2.** Frequency analysis of respondent's appearances in analyzed official football matches.

Initials	Player's position	Appearances (absolute value)	Appearances (percentage)
RB	Defender	13	8,1
YS	Midfielder	13	8,1
AG	Forward	12	7,5
AP	Defender	12	7,5
CI	Midfielder	12	7,5
DA	Defender	12	7,5
MO	Midfielder	12	7,5
SA	Defender	12	7,5
SG	Forward	12	7,5
BD	Defender	11	6,8
DA	Forward	10	6,2
NH	Defender	9	5,6
IP	Midfielder	8	5,0
DB	Midfielder	6	3,7
AR	Midfielder	4	2,5
KA	Forward	1	,6
PG	Defender	1	,6
VZ	Forward	1	,6
<b>Total</b>		<b>161</b>	<b>100,0</b>

The total covered distance from ninety-minute football match (plus additional time from the two half times) has average value of 8505 m, ranging from 140 m for substitute players to the

impressing 12195 m. We analyze only official playing time, excluding warmup and halftime rest (Table 3).

**Table 3.** Covered distance descriptive statistics.

	N	Range	Minimum	Maximum	Mean	Std. Deviation	Skewness	Kurtosis
<b>Covered distance</b>	161	12055	140	12195	8505	3051	-1,07	0,15

In order to gain more complete idea of the functional capabilities (presented by covered distance) of football players from the second professional league in Bulgaria, we consider it necessary to first analyze each football match separately, studying the performance of the players for each match as summarized data. The sum of covered distance by the team is good index for the team effort and gives information regarding their conditioning status. The team covers distance between 93643 m and 113139 m which in our opinion is good indicator for a professional team from the second level of

Bulgarian football. The average distance covered by the team field players is around 105 km. The data regarding maximum covered distance by a single player in match is close to world elite – 11569 m average for the thirteen matches with lowest value of 10713 m. We must note that the average value of covered distance for a single player (average for the whole team – starting 10 field player plus 3 substitute players) ranges between 7 and 9 km, which again is good value close to higher levels of professional football players in Europe.

**Table 4.** Descriptive statistics for each played match of PFC CSKA 1948 for the spring season of 2018/2019 Second Bulgarian professional league.

№	Date	Match	Result	Win, draw, lost	Sum of covered distance in m (incl. starting and substitutes)	Max. covered distance in m by single field player	Average distance cover by field players (in m) per match
1	26.2.2019	CSKA 1948-Kariana (Erden)	2-1	W	113139	12195	8703
2	4.3.2019	Montana-CSKA 1948	2-2	D	107532	11629	8272
3	8.3.2019	CSKA 1948-Strumska slava (Radomir)	3-0	W	110110	11615	8470
4	17.3.2019	Ludogorets II (Razgrad)-CSKA 1948	0-1	W	101124	11208	7779
5	1.4.2019	CSKA 1948-Litex (Lovetch)	1-0	W	109321	11703	8409
6	6.4.2019	Dobrudja (Dobrich)-CSKA 1948	0-0	D	106595	11331	8200
7	15.4.2019	CSKA 1948-Pirin (Blagoevgrad)	2-1	W	104654	11746	8050
8	22.4.2019	Tsarsko selo (Sofia)-CSKA 1948	0-0	D	105299	12067	8100
9	30.4.2019	CSKA 1948-Nesebur	2-0	W	102495	11442	7884
10	5.5.2019	Pomorie-CSKA 1948	1-2	W	107645	11875	8280
11	10.5.2019	CSKA 1948-Lokomotiv (G. Oriahovitsa)	4-0	W	101389	11304	7799
12	19.5.2019	Arda (Kurdzali)-CSKA 1948	1-0	L	93643	10713	7203
13	23.5.2019	CSKA 1948-Lokomotiv (Sofia)	3-1	W	106402	11565	8185
<b>sum</b>					<b>1369348</b>		
<b>average</b>					105334	11569	
<b>min.</b>					93643	10713	
<b>max.</b>					113139	12195	
<b>std. dev.</b>					4924	387	
<b>range</b>					19496	1482	

Based on **Table 4** we developed evaluation table for scoring team performance regarding total covered distance in a single match by all field players using seven level evaluation scale using

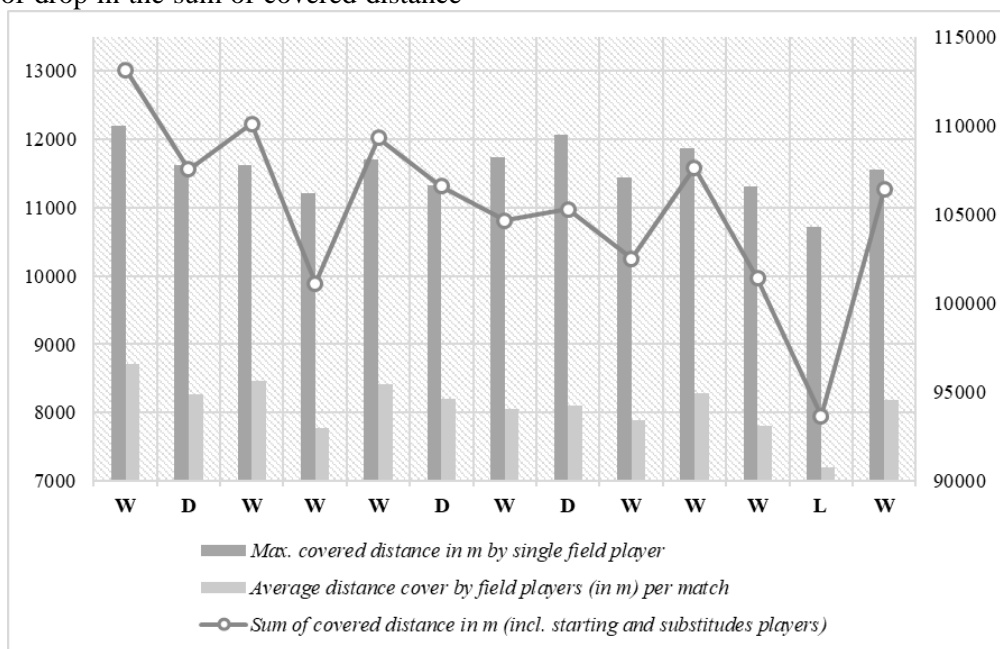
Signal method. Also, we can evaluate the performance of a single player with maximal covered distance from the team again using the same approach.

**Table 5** Evaluation table (7 scales) developed using Signal method.

Evaluation	Sum of covered distance in m (incl. starting and substitutes players)	Max. covered distance in m by single field player
<b>Very high</b>	over 115182 m	over 12343 m
<b>High</b>	110259-115182 m	11957-12343 m
<b>Above average</b>	107797-110258 m	11764-11956 m
<b>Average</b>	102872-107796 m	11376-11763 m
<b>Below average</b>	100410-102871 m	11182-11375 m
<b>Low</b>	95486-100409 m	10795-11181 m
<b>Very low</b>	below 95486 m	below 10795 m

Data regarding covered distance in official matches from the second professional league in Bulgaria is presented on **Figure 2**. We can note tendency of drop in the sum of covered distance

by the whole team. Maximal and average covered distance by a single player is logically connected to the team performance.



**Figure 4.** Covered distance by field players in official matches.

In addition to the total covered distance analysis above, the analysis of the distance covered with different speed (divided into 5 speed zones) will complete the picture related to mobility of football players. The speed zones are divided as follows (**Table 5** and **Figure 5**):

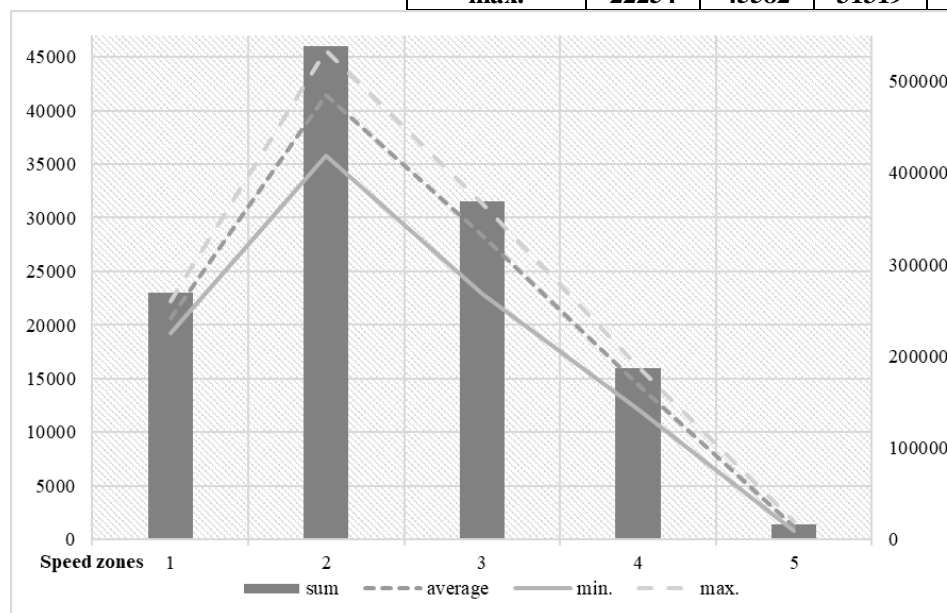
- speed zone 1 (0,00-4,99 km/h) – walking.
- speed zone 2 (5,00-10,79 km/h) – fast walking or jogging.
- speed zone 3 (10,80-16,19 km/h) – running with moderate speed.
- speed zone 4 (16,20-25,19 km/h) – running with high speed.
- speed zone 5 ( $\geq 25,20$  km/h) – sprinting.

The respondents speed zone profile shows largest distance to be covered in speed zone 2, following by speed zone 3. In our opinion the difference between elite football players and our

respondents from the second league of Bulgarian football is lower values in speed zones 4 and 5 which makes movement of the pitch more dynamic.

**Table 5** Descriptive statistics for each played match of PFC CSKA 1948 for the spring season of 2018/2019 Second Bulgarian professional league – covered distance in different speed zones 1-5.

№	Date	Match	Result	Win, draw, lost	Speed zone 1 (m)	Speed zone 2 (m)	Speed zone 3 (m)	Speed zone 4 (m)	Speed zone 5 (m)
					(0.00 - 4.99 km/h)	(5.00 - 10.79 km/h)	(10.80 - 16.19 km/h)	(16.20 - 25.19 km/h)	(25.20- km/h)
1	26.2.2019	CSKA 1948-Kariana (Erden)	2-1	W	19553	44494	31319	16081	1691
2	4.3.2019	Montana-CSKA 1948	2-2	D	22254	41053	29419	15731	1576
3	8.3.2019	CSKA 1948-Strumska slava (Radomir)	3-0	W	19198	45582	30087	15513	1113
4	17.3.2019	Ludogorets II (Razgrad)-CSKA 1948	0-1	W	21530	41373	27197	13393	1080
5	1.4.2019	CSKA 1948-Litex (Lovetch)	1-0	W	21283	43117	30881	15078	973
6	6.4.2019	Dobrudja (Dobrich)-CSKA 1948	0-0	D	20400	41823	29129	13968	1276
7	15.4.2019	CSKA 1948-Pirin (Blagoevgrad)	2-1	W	19999	39558	28960	14547	1592
8	22.4.2019	Tsarsko selo (Sofia)-CSKA 1948	0-0	D	21603	40855	28469	13161	1213
9	30.4.2019	CSKA 1948-Nesebur	2-0	W	20584	39574	27513	13809	1015
10	5.5.2019	Pomorie-CSKA 1948	1-2	W	20820	43220	27978	14641	988
11	10.5.2019	CSKA 1948-Lokomotiv (G. Oriahovitsa)	4-0	W	19449	40547	26701	13450	1245
12	19.5.2019	Arda (Kurdzali)-CSKA 1948	1-0	L	22005	35796	22939	12135	767
13	23.5.2019	CSKA 1948-Lokomotiv (Sofia)	3-1	W	20067	41267	28404	15184	1479
<b>sum</b>					<b>268745</b>	<b>538259</b>	<b>368996</b>	<b>186691</b>	<b>16008</b>
<b>average</b>					<b>20673</b>	<b>41405</b>	<b>28384</b>	<b>14361</b>	<b>1231</b>
<b>min.</b>					<b>19198</b>	<b>35796</b>	<b>22939</b>	<b>12135</b>	<b>767</b>
<b>max.</b>					<b>22254</b>	<b>45582</b>	<b>31319</b>	<b>16081</b>	<b>1691</b>



**Figure 5.** Covered distance in the different speed zones.

## CONCLUSION

The following study reveals information regarding professional football in Bulgaria which enriches sport theory and practice. Also, we present a way for performing analysis of data regarding covered distance as a team and individual analysis – both in total covered distance and distance covered in different speed zones.

Based on the results we can conclude that the level of second league players from Bulgaria do not yield in terms of total distance covered during official matches compared to higher levels of European football. We find a difference in the distance covered in higher speed zones (zone 4 and 5).

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