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MAST 397

16 October 2023

Project #1: Passing Impact Factor

Today we will be looking at one of our road matches that took place on Thursday evening where we, Thunderstrike United, took on our divisional rivals, Solar Flare FC, and unfortunately lost three-nil, letting in two in the second half. Our match is perfect to analyze since none of the star players on both teams were injured, the start of the match was at our usual time (7:00 pm), and we sat in similar positions in our league's standings. Our soccer match analyst claims this loss had an alarming increase in the number of turnovers and decrease in the number of shots at certain parts of the match compared to past wins. He claims this is due to us increasing our passing distance every time we were scored on. Our task is to find out how high can the average passing distance between goals get before it causes more turnovers and less shots for us at important parts of the game. According to Kelly O'Hara, two-time FIFA World Cup Champion, working on passing and receiving the ball leads to more shots and less turnovers (Versus, "Soccer Passing and Receiving"). To verify our match analyst's claim, we must assign an impact factor that relates to our passing.

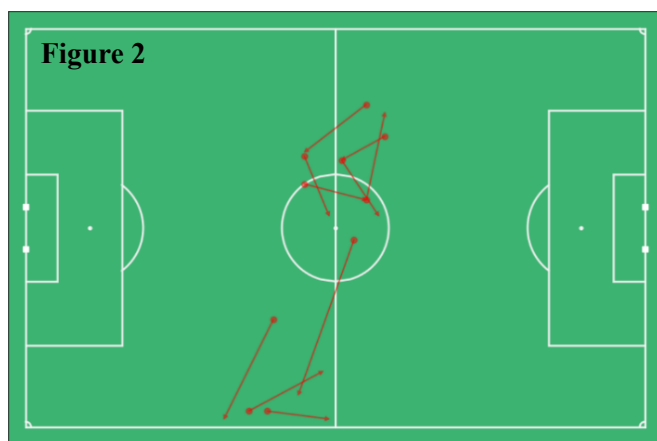
Our impact factor decided for this analysis was our team's passing distance for completed passes excluding goal kicks, headers, and clearing attempts. Since our match analyst believes our average passing distance of the ball increases between every goal, individual impact factors were calculated for while the match was tied, trailing by one in the first half, trailing by one in the

second half, passes while we were trailing by two in the second half, and finally, passes while we were trailing by three in the second half. We calculated two separate impact factors for when we were down by one for each half because it didn't seem right to include it together with a break in between. Combining them would include passing distances of us being unenergized at the end of one half and being recharged at the beginning of another. We used this computer code to find the individual impact factors:

```
Impact_Factor_C = 0
for index, row in Down_One_Second_Half.iterrows():
    distance_C = (((row["End X"] - row["Start X"]) ** 2 + (row["End Y"] - row["Start Y"]) ** 2) ** 0.5)
    if distance_C > 0:
        Impact_Factor_C += distance_C
```

Figure 1

Before Solar Flare FC scored their first goal, Thunderstrike made completed 10 passes (their trajectories are shown in Figure 2) and recorded an impact factor, total passing distance, of 142 metres. This translates to an average passing distance of 14.2 metres long. To find this number, we looked at our tracking data that records every event, such as passes, shots, goals, inceptions, etc. in this game including all our games this season. Our match analyst told us that

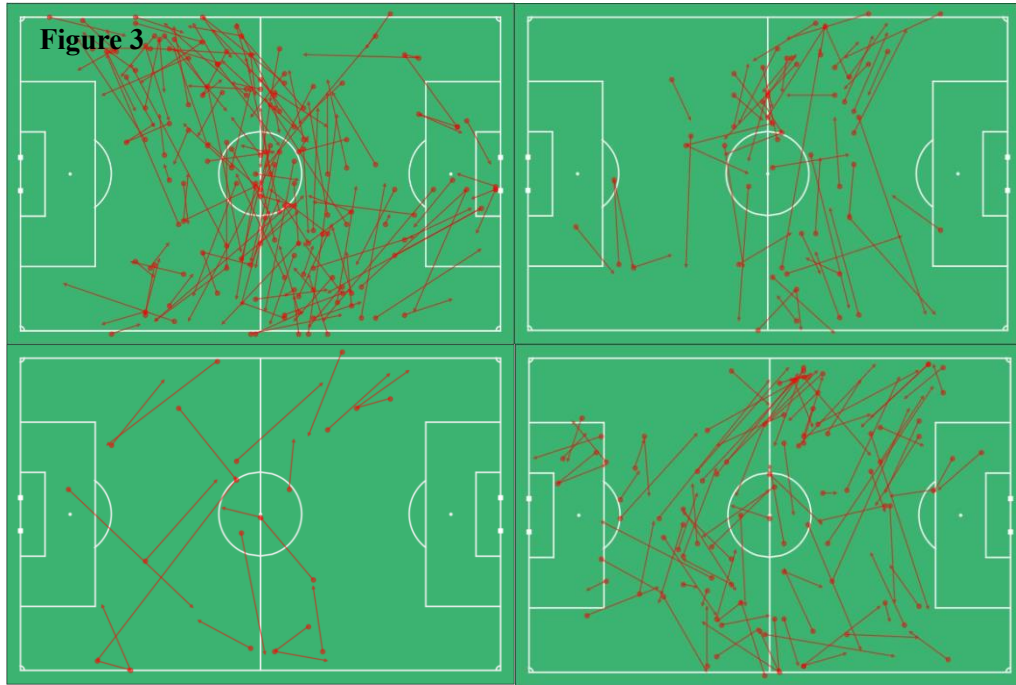


once this goal was scored, our team started rushing to score a tying goal and increased their passing distance. He talked to the coach and assistant coaches about making tactical adjustments such as changing formations to avoid causing turnovers (“How to Make a Comeback”).

From the first goal to the end of the half, our team completed 160 passes (top left of Figure 3), equaling an impact factor of 2638 metres, and passing an average distance of 16.5 metres. While trailing by one in the second half, Thunderstrike completed 56 passes (top right of

Figure 3), an impact factor of 936 metres, averaging an impact factor of 16.7 metres per pass.

For passes between Solar Flare's second and third goal, 21 passes (bottom left of Figure 3), and an impact factor of 403 metres averaging 19.2 metres. Finally, from the last goal (scored around the end of the third quarter of the game) until the end of the match, about 16.1 metres per pass with 1545 metres of passing distance and 96 passes (bottom right of Figure 3).



Looking at the how similar the margins of shots, turnovers, and goals are with each other between Thunderstrike United and Solar Flare FC, it is safe to say that our average passing distance had an impact on the final score. Table 1 shows how the shots, interceptions and goals looked between each quarter of the match:

Table 1	First Quarter (00:00 – 22:30)		Second Quarter (22:30 – 45:00)		Third Quarter (45:00 – 67:30)		Fourth Quarter (67:30 – 90:00)	
	Home	Away	Home	Away	Home	Away	Home	Away
Turnovers	43	43	30	27	22	24	35	34
Thunderstrike's Turnover Differential	0		3		-2		1	
Shots	6	2	5	0	4	1	3	3
Thunderstrike's Shot Differential	-4		-5		-3		0	
Goals	1	0	0	0	2	0	0	0
Thunderstrike's Goal Differential	-1		0		-2		0	

The third quarter proves how important it is for us to implement a maximum average passing distance. This quarter contains the two highest of the five impact factors whose average distances are 16.7 metres and 19.2 metres and were outplayed in turnovers, shots, and goals. We determined that we should set it at 16 metres because it was the average passing during our most dominant quarter, the fourth quarter. This metric is interesting because even though we are trying to make longer passes to tie the game after getting scored on, once the average reaches a certain distance, it costs us the match. This impact factor works for “this” specific game because there was more than one goal scored which many passes in between. It falls shorts in a match with only one goal and falls shorter when the goal happens very early, very late, or not at all. We can expand this from calculating an impact factor between every goal to every shot to get more impact factors and have more precise increases in passing distances.

Works Cited

- “How to Make a Comeback When Your Team is Behind.” *Fifplay*, <https://www.fifplay.com/how-to-make-a-comeback-when-your-team-is-behind/>.
- “Soccer Passing and Receiving.” *Versus*, 3 Oct. 2023, <https://versus.co/learn/soccer-passing-and-receiving>.