

Risky Business Week 17

The Last Two Minutes in Cincinnati

There was enough drama and controversial decision-making during the final two minutes of the Bengals/Chiefs game to dominate the Week 17 headlines. Although they came up short on three prior attempts from the Chiefs' 1-yard line, the Bengals stayed the course and still went for it on fourth down with the score tied and less than one minute remaining in the game. After off-setting penalties on the first fourth-and-goal attempt, the Bengals once again went for it and this time benefited from an 'illegal use of hands' penalty on the Chiefs' L'Jarius Sneed. Now the Bengals were able to run the clock down for a game winning field goal. Many questions immediately followed around the decision not to kick on the fourth-and-one, and whether the Chiefs would have benefited by intentionally letting the Bengals score on first down after the two-minute warning.

First, let's examine the fourth-and-one decision that induced the fatal penalty on the Chiefs. A custom simulation, with full consideration to turnovers, penalties, and overtime scenarios, suggests this was a significant error by the Bengals. A field goal attempt would have produced 8.7% more wins on average. While the model plays out hundreds of thousands of simulated games to reveal the value of kicking the field goal, it can be helpful to construct a simple decision tree to see what might be going on here.

First some assumptions derived from NFL historical data and model analysis.

- Bengals successfully score a touchdown and kick a PAT 57% of the time
- Bengals successfully kick a field goal 98% of the time
- Chiefs can win 15% of games when trailing by 3 with no timeouts and 45 seconds from 25-yard line.
- Chiefs can win 4% of games when trailing by 7 with no timeouts and 45 seconds from 25-yard line.
- Chiefs are a 52% favorite in overtime
- Chiefs can win 58% of games when tied with no timeouts and 45 seconds from their own 25-yard line
- Chiefs can win 48% of games when tied with no timeouts and 45 seconds from 1-yard line (note the ball position and clock make this a little worse than their chances in OT)
- Ties count as ½ win.

Bengals go for win

- $(.57)(.96) + (.43)(.52) = 77.1\%$ GWC

Bengals kick Field Goal

- $(.98)(.85) + (.02)(.42) = 84.1\%$ GWC

Note: The figures from the decision tree are more generalized and do not account for all the scenarios picked up in the simulation. However, it still provides strong support the field goal attempt.

The question of whether the Chiefs should have allowed the Bengals to score a touchdown at the two-minute warning is a bit more complicated. First let's set some assumptions.

- The Bengals will try to score a touchdown on fourth-and-goal from the 1-yard line.
- The Bengals will kick the extra point to go up 38-31 after the touchdown
- The Chiefs will only voluntarily allow the Bengals to score a touchdown on first down at 2:00 and the Bengals will oblige.
- The Bengals can convert the touchdown 57% from the 1-yard line (without assistance from the Chiefs) and each subsequent attempt will be identical.
- The Chiefs have 19.3% GWC per the simulation to win the game trailing 38-31 with 1:55 remaining and two timeouts from their own 25-yard line.

Per these assumptions, the Bengals will score a touchdown on each specific down as follows:

Down	Probability of Scoring a Touchdown on this Down	Approximate Time Remaining after the Score and Timeouts	Chiefs Resulting GWC (per simulation)
First	57%	1:55 2 TO	19.3%
Second	24.5%	1:50 1 TO	17.1%
Third	10.5%	1:45 0 TO	14.4%
Fourth	4.6%	0:58 0 TO	6.7%
(no score)	3.4%	0:50 0 TO	48.0%

In this more generalized analysis, the weighted average of GWC for the Chiefs is 18.4% without voluntarily offering the touchdown, and 19.3% if they do. A custom simulation shows the Chiefs to be only 17.0% without volunteering the touchdown on first down. While the decision is somewhat close, it appears correct to give them the touchdown at first opportunity. Even if the Chiefs knew the Bengals would correctly kick the field goal on fourth down it is still more favorable for them to volunteer the touchdown on first down.