Route Combinatorics

Analyzing Route Combination Success vs Defensive Structure in the 2020 NFL Season

2021 SIS Analytics Challenge

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Introduction

Introduction

Goal:

- **Identify "successful" coverages** vs the "most popular" route combinations in the 2020 NFL season.

Additionally:

- Investigate how **personnel positioning** affects play success

Data

Although the option was **available to use outside sources**, data used in this project was **strictly limited** to the Sports Info Solutions dataset.

This set featured enough granularity to provide a satisfactory answer to the "General Track" prompt.

Data: Coverages

While there are many different coverages tracked by the SIS data, only "major" coverages will be used in this study.

Coverage Scheme Usage
NFL: 2020 | Major Coverages

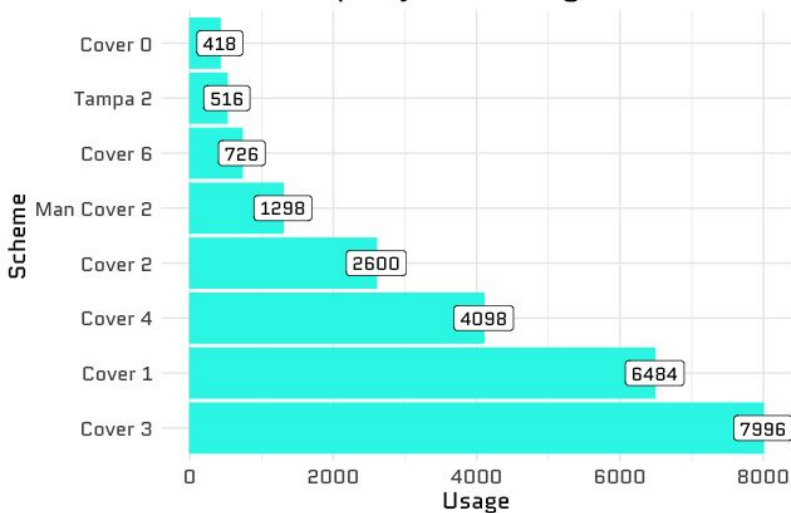| Scheme	Usage
Cover 0	418
Tampa 2	516
Cover 6	726
Man Cover 2	1298
Cover 2	2600
Cover 4	4098
Cover 1	6484
Cover 3	7996

Figure: OU SDAA | Data: Sports Info. Solutions

Defining "Success"

The working definition of "success" in this project is:

Explosiveness + Reliability:

- Explosiveness: High EPA*
- Reliability: High Completion %

RATING = [Standardized Average EPA] + [Standardized Average Completion %]

* EPA [Expected Points Added] is derived from the Sports Info Solutions dataset.

End Product

- A simple, **handheld "hit chart"** similar to those seen in games like blackjack
- Practical usage would be for coaches to **quickly identify advantages/disadvantages in coverages**
  - **Offense:** Calling audibles at the line upon seeing coverages
  - **Defense:** Comparing opponents' route combinations to coverages best suited to defend them

Assumptions/Factors

Formations: Orientation

An offense may choose to align their receivers in many different ways.

Orientation (ex. 3x1 vs 1x3) was not found to have a significant impact on the average EPA of a play across the NFL*.

Strength Orientation
NFL: 2020 | Unbalanced Formations

Figure: OU SDAA | Data: Sports Info. Solutions
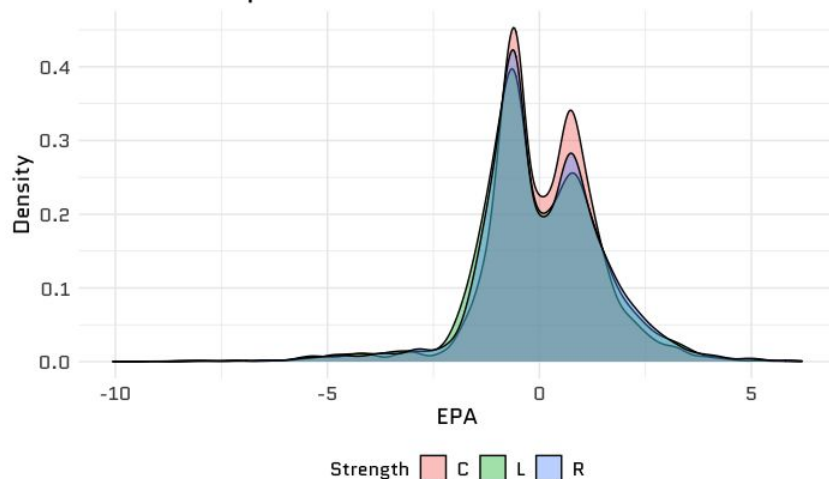
* It's possible handedness of QB is a factor here, but there is no data to determine this

FIB

Given the geometry of a football field, there will be a "**boundary side**" and a "**field side**" of most plays.

- Boundary Side = Short Side
- Field Side = Long Side

If an offense sets its **passing strength (more receivers) toward the short side** of the field, this is called "Formation into Boundary", or FIB.

We will **only consider non-FIB** plays.
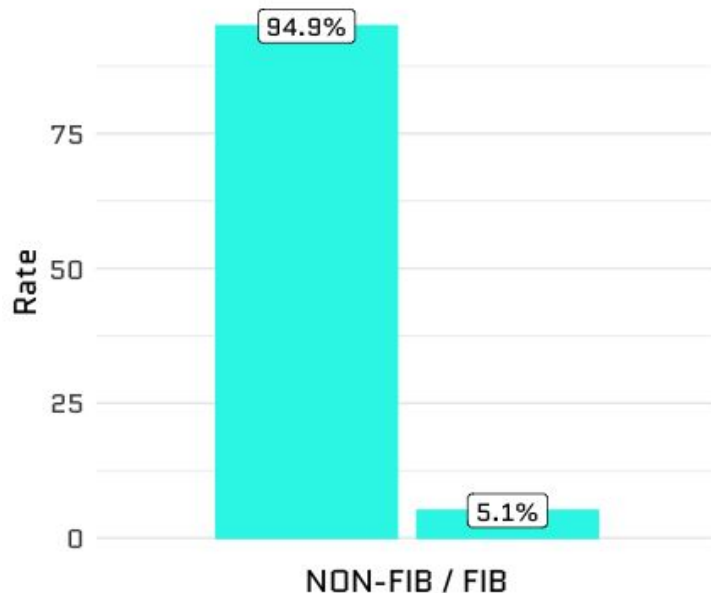
FIB Usage
NFL: 2020 | Major Coverages

Figure: OU SDAA | Data: Sports Info. Solutions

Personnel, Positioning

The **position of the TE**, whether they be the #1 receiver or the #3 receiver, **seems to have a significant impact** on the EPA success of a play.

Thus, while a Curl-Curl-Chip/Flat route might work best for an offense, **it certainly matters which route a TE is running**.

EPA Density by TE Position
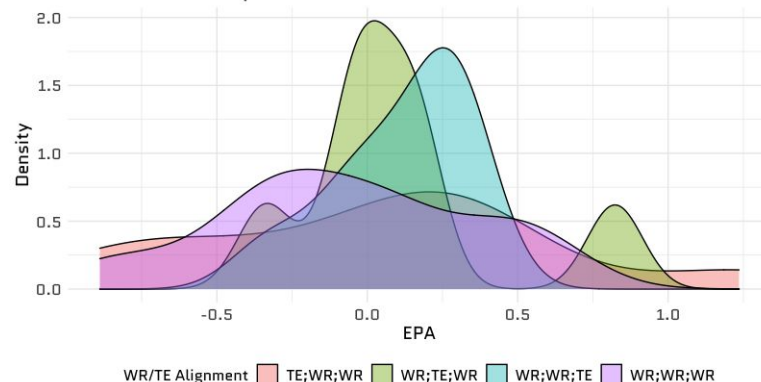3 Man Routes | NFL: 2020


Figure: OU SDAA | Data: Sports Info. Solutions

Analysis

Popular Route Combinations

3 REC COMBINATIONS	
Combination	Count
Curl::Curl::Curl	97
Go/Fly::Out::Out	96
Curl::Fade::Curl	93
Curl::Curl::Chip-Flat	72
Curl::Fade::Out	66

2 REC COMBINATIONS	
Combination	Count
Go/Fly::Out	519
Curl::Curl	472
Slant::Slant	380
Fade::Out	321
Curl::Seam	304

It is worth noting many 2 REC combinations are prevalent in 3 REC combinations

Initial Methods

FILTER
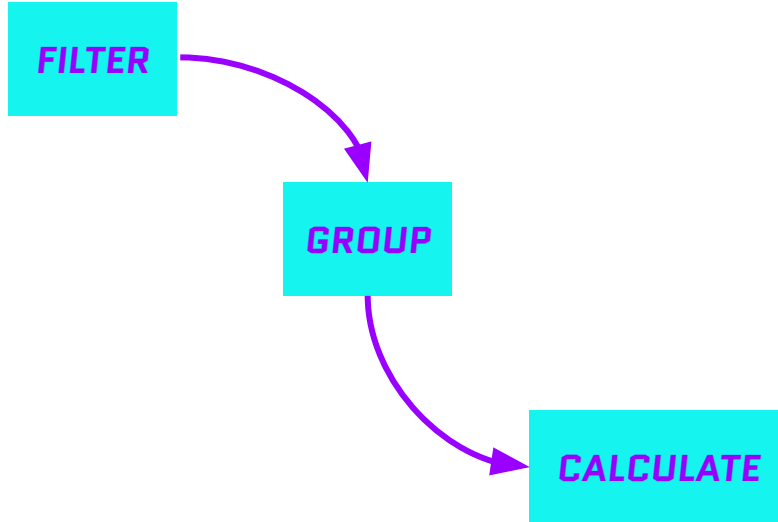
GROUP

CALCULATE

Filter for generality:

- Non-FIB
- Non-Screen
- Major Coverages
- Major Routes (previous)

Group by:

- Coverage
- Route Combination

Calculate:

- Bootstrapped EPA, Bootstrapped CMP%
- Success Rating (defined earlier)

The General Answer

Notice that the **semi-paired patterns** [Go/Fly;Out & Go/Fly;Out;Out] have **similar coverage weaknesses**. A notable and interesting exception is 2 curls vs 3 curls.

Practical Usage:

- Audibling
- Calling timeouts
- Blitz call timing

Pattern vs. Coverage Hit Chart
NFL: 2020 | Major Coverages | Non-FIB

	Cover 0	Cover 1	Cover 6	Tampa 2	Cover 3	Cover 4	Cover 2	Man Cover 2
Slant;Slant	D	D	O	D	O	D	D	O
Go/Fly;Out;Out	D	O	O		O	D	O	O
Go/Fly;Out	D	D	O	O	O	D	O	D
Fade;Out	D	D	D	D	D		O	O	O
Curl;Seam	O	D	D	O	O	D	D	O
Curl;Fade;Out	D	O	D		D		O	O
Curl;Fade;Curl	O	D	D		D	O	O	
Curl;Curl;Curl	D	D	D	O	O	D	O	O
Curl;Curl;Chip - Flat	O	D	D	D	D	D	O	O
Curl;Curl	O	D	O	D	O	D	O	O

Figure: OU SDAA | Data: Sports Info. Solutions

The General Answer: Continued

Coverage Rating vs. Popular Routes
NFL: 2020 | Major Coverages | Non-FIB
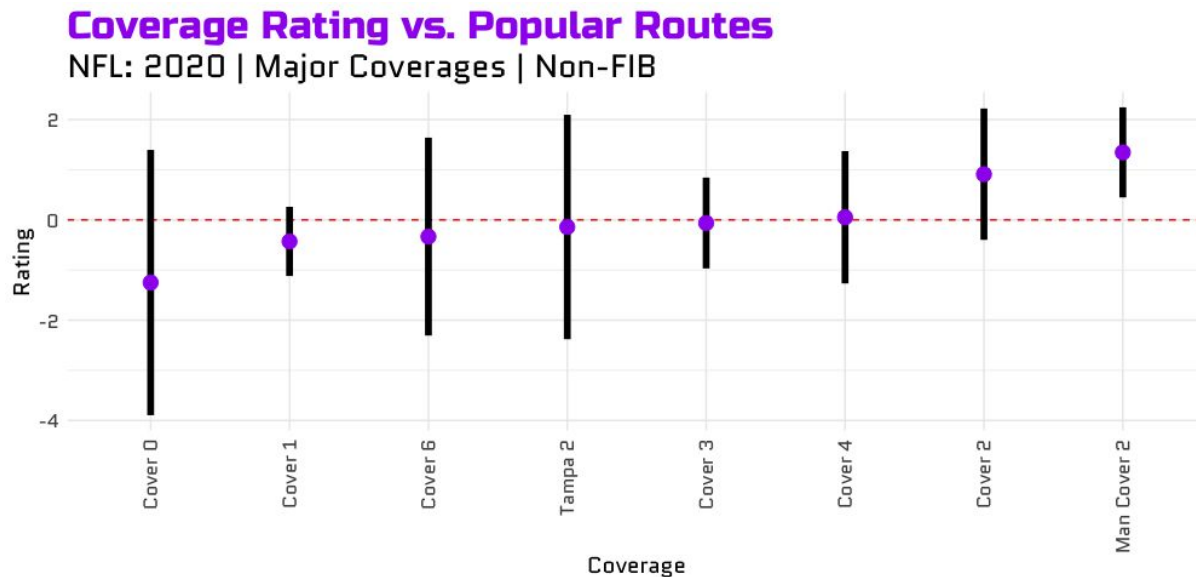
Figure: OU SDAA | Data: Sports Info. Solutions

Scenario

Ex: Game Planning for Chiefs

Most popular routes run against Chiefs and their performance shown in figure

We have a great chance at a successful hit rate with a Fade:Out 2-man route combo against a Cover 2, for example.

Issues:
- Small sample size necessitates bootstrapping
- 3-man route combos are not repeated often enough for significant data

Pattern vs. Coverage Hit Chart
Chiefs Defense: 2020

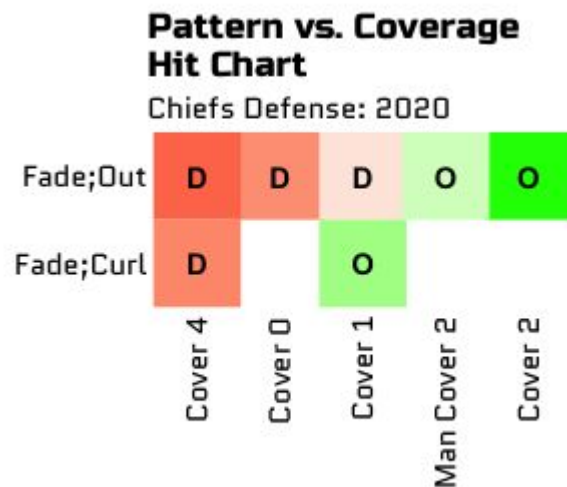|	Cover 4	Cover 0	Cover 1	Man Cover 2	Cover 2
Fade;Out	D	D	D	O	O
Fade;Curl	D		O		

Figure: OU SDAA | Data: Sports Info. Solutions

Future Work

Multi-Year Analysis

The primary limitation for this project was a **lack of data.**

With a larger dataset, more accurate, data-filled hit charts could be created to aid in decision making. Across years, trends could also be identified.

These could be broken down further for:
- **Specific coordinators**
- **Down/distance**
- **Red zone/open field**
- **Postseason strategy**

Conclusion

The Best Coverages

Overall, `Cover 0` **performed best against the top route combinations**

- High variability in success
- Often run in situations where EPA is in diminishing returns range

In open field, **single-high safety looks are more stable** than two-high safety looks

- `Cover 1, Cover 3`
- Cover 2, Cover 4 lead to more offensive success, Tampa 2 has higher variability

While orientation to strength of the field does not matter, **WR/TE positioning does**

- As shown previously on Slide 11

Thank You!

Appendix A

Pattern vs. Coverage Hit Chart
NFL: 2020 | Major Coverages | Non-FIB

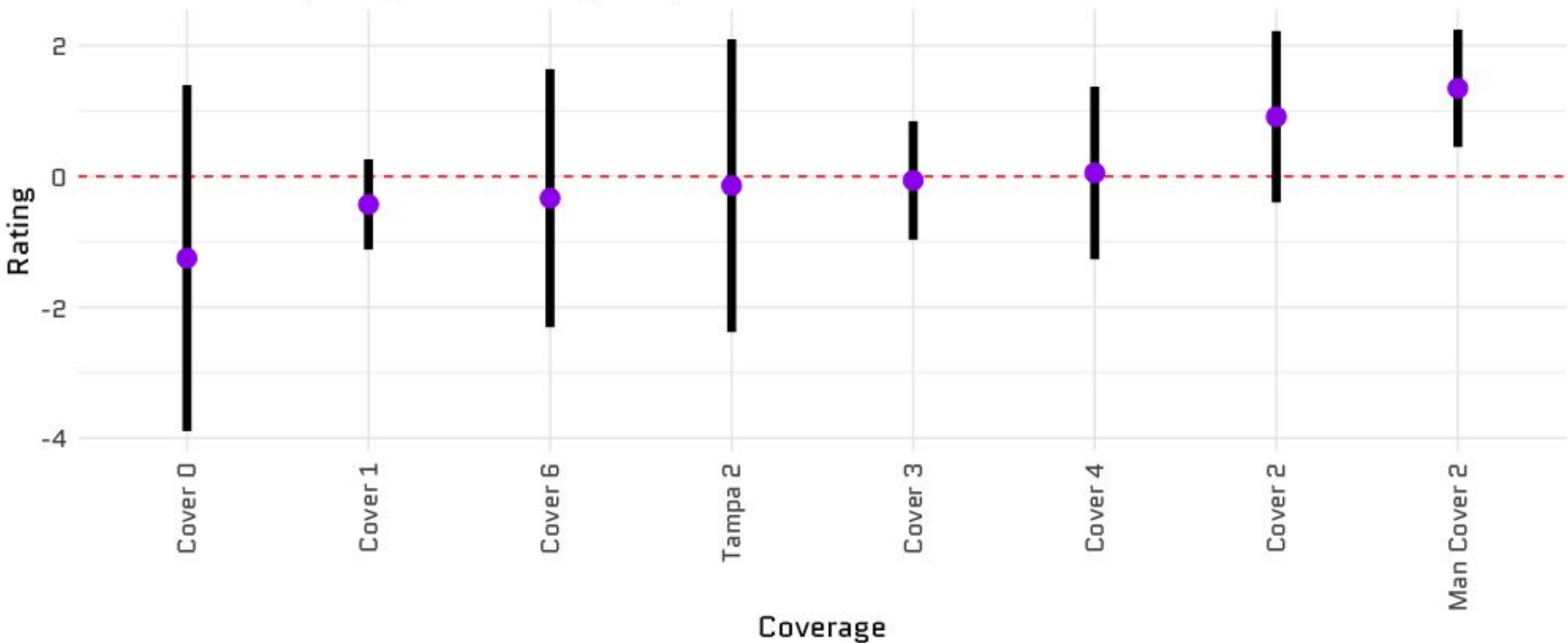|	Cover 0	Cover 1	Cover 6	Tampa 2	Cover 3	Cover 4	Cover 2	Man Cover 2
Slant;Slant	D	D	O	D	O	D	D	O
Go/Fly;Out;Out	D	O	O		O	D	O	O
Go/Fly;Out	D	D	O	O	O	D	O	D
Fade;Out	D	D	D	D	D	O	O	O
Curl;Seam	O	D	D	O	O	D	D	O
Curl;Fade;Out	D	O	D		D		O	O
Curl;Fade;Curl	O	D	D		D	O	O	
Curl;Curl;Curl	D	D	D	O	O	D	O	O
Curl;Curl;Chip - Flat	O	D	D	D	D	D	O	O
Curl;Curl	O	D	O	D	O	D	O	O

Figure: OU SDAA | Data: Sports Info. Solutions

Appendix B

Coverage Rating vs. Popular Routes
NFL: 2020 | Major Coverages | Non-FIB

Figure: OU SDAA | Data: Sports Info. Solutions