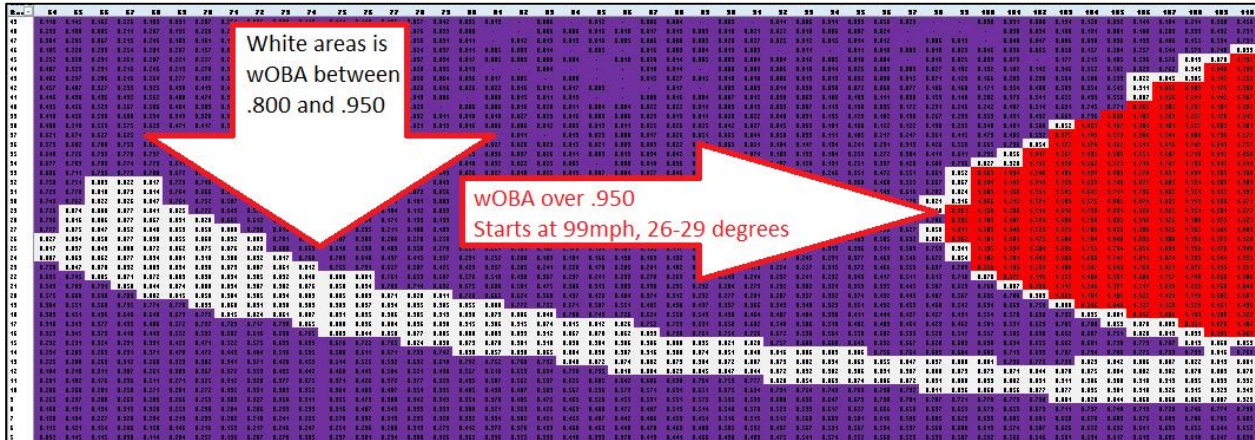


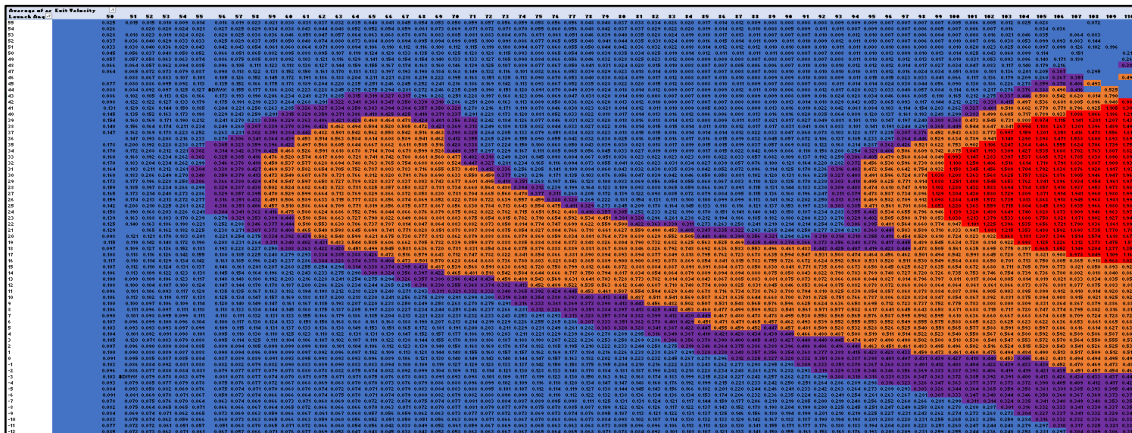
Barrel Classification Updates

At the end of the 2016 season, Statcast released the metric of [barrels](#) to classify the launch angle and exit velocity combinations that lead to the best contact. While a barrel is defined as a well-struck ball where the combination of exit velocity and launch angle generally leads to a minimum .500 batting average and 1.500 slugging percentage, it was [created based on wOBA](#). The barrel zone is defined as .950+ wOBA, mostly because .950+ wOBA fell nicely into one zone. While .800+ wOBA is still a fantastic result, it didn't fit neatly into one area (see below), so .950+ worked as an initial boundary.

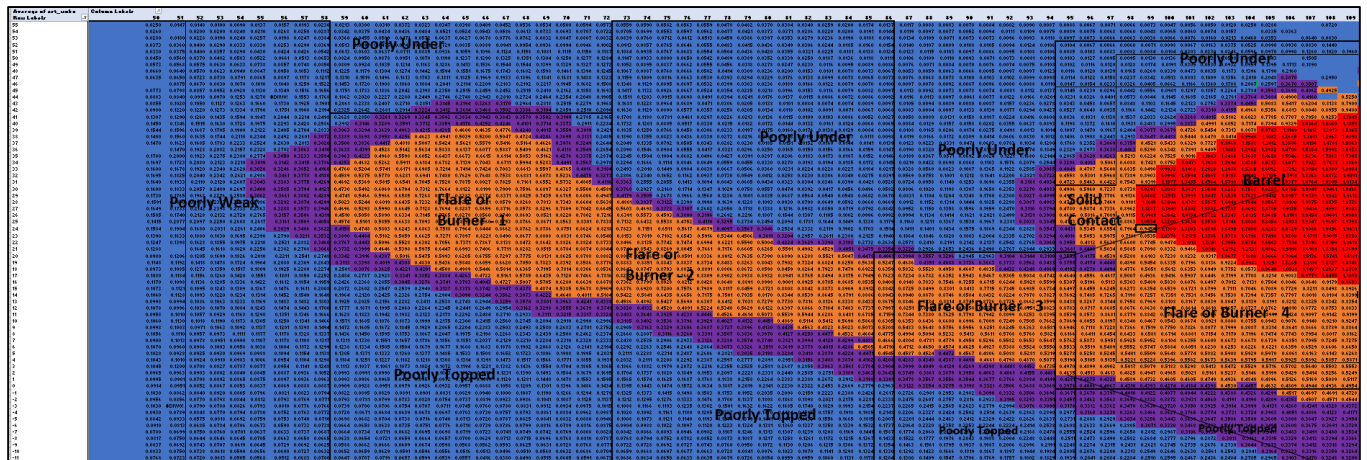


And so, using wOBA as the initial guideline, Tom developed a model classifying quality of contact based on launch angle and exit velocity into six categories: *Barrel*, *Quality Contact*, *Flare or Burner*, *Poorly Topped*, *Poorly Under*, and *Poorly Weak*. However, when he made the model in 2016, he had only 2015 and 2016 data to work with. Now that we have over two and a half more seasons of data, Tom asked me to look into the 2016 model, and see if the definitions for the six categories still worked. For the most part, they still fit, but some tweaking was needed along the edges of the zones. While going through the tweaks that needed to be made, I'll shine some light on the modeling process for speed-angle classification.

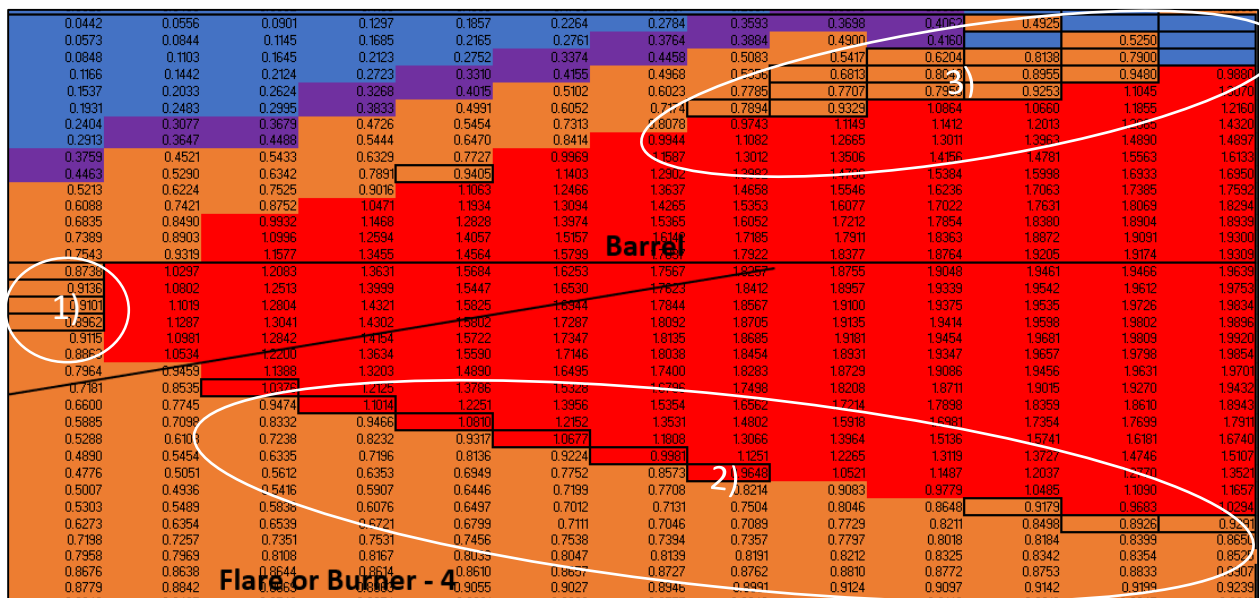
First, the average wOBA value for each exit velocity (columns) and launch angle (rows) is generated. Then, we categorize the combinations by their wOBA values using conditional formatting: blue for cells with wOBA under .300, purple for cells with wOBA between .300 and .450, orange for cells with wOBA between .450 and .950, and red for cells with wOBA over .950 (our Barrel Zone).



Next, I applied Tom's [original conditions](#) to categorize the data. The speed-angle combinations are broken up into 15 sections, with the Flare or Burner or Poorly categories extending over many areas. In general, we want blue cells to be Poorly Hit, red cells to be Barrels, the orange cells hugging the Barrel Zone to be Solid Contact, and the other orange cells to be Flare or Burners. The purple cells are a buffer – they can be either Flare or Burners or Poorly Hit. The objective is to create exit velocity and launch angle conditions that target only cells with the proper color. For example, in the Barrel Zone, we need conditions that include all the red cells and exclude all the orange cells. For the Poorly Hit zones, we want to maximize the number of blue cells and exclude the orange cells, and so on for each category.



Looking at Tom's conditions for 2016, the Barrel Zone needed the most tweaking – this makes sense, as there is no "buffer" in the barrel zone, and the combinations of high-angle and high-speed in the right corner have the least data. Looking at his original conditions, there were three zones of cells that were misclassified (see cells with a black border):



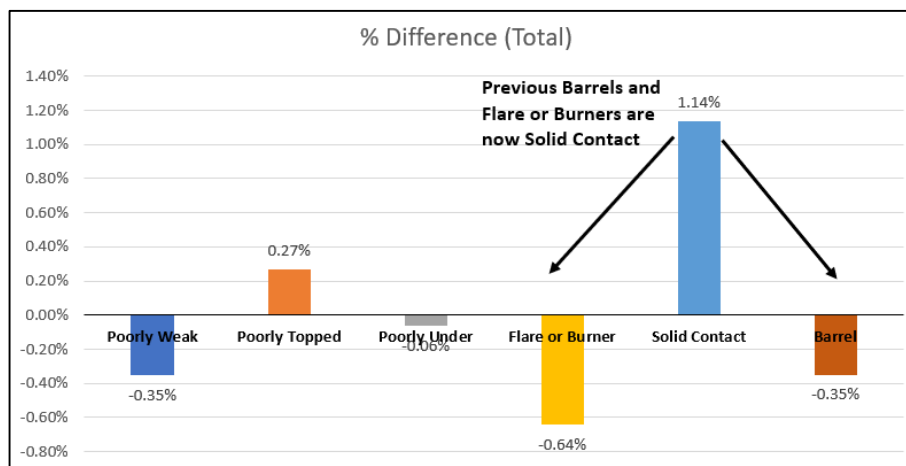
The red cells with black borders were not included in the original barrel classification, and the orange cells with black borders were included. Most of the orange cells were borderline cases, with wOBA close to the .950 mark. To decide what to do with the borderline cases, we looked at average distance by exit

velocity and launch angle with over 380ft as the guideline for barrels. The orange cells in Section 1 had average distances between 373ft and 378ft, so we decided to keep them as barrels as to not increase the minimum barrel exit velocity from 98mph to 99mph.

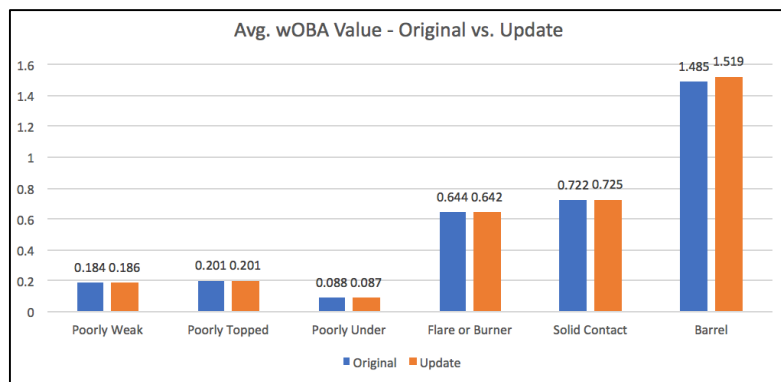
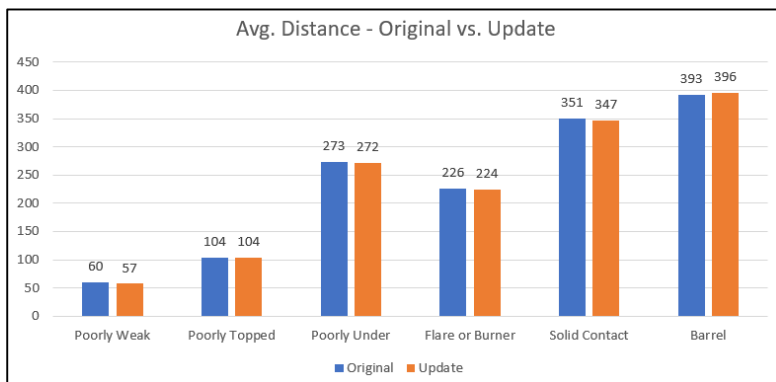
To tweak the conditions for the cells in Section 2, another condition $((1.5 * \text{angle} + \text{speed}) \geq 132)$ was added to include the red cells and exclude the orange cells, which did not have average distances near the 380ft mark.

Lastly, in Section 3, another condition $((\text{speed} - 1.5 * \text{angle}) \geq 46.5)$ was needed to narrow the Barrel Zone to just the red cells. And so, the process went on with the other categories, evaluating current boundaries and creating new lines to fit to the updated data.

After the updates were proposed, I compared my updated conditions to Tom's originals by looking at the percent change of each category:



The Barrel Zone has narrowed slightly with Solid Contact picking up the shifted cells. We wanted to ensure that, while the boundaries may change for the six speed-angle categories, the outcomes do not. The average distances changed a maximum of 4ft, and wOBA remained about the same with the exception of Barrels. Barrel wOBA increased as the zone became more restricted after more data was available.



Tom reviewed my changes and will implement them in the off-season. For now, we wanted to give an update on the classification of Barrels, and a deeper view into how the classifications are developed.