

To Red Flag or not to Red Flag?



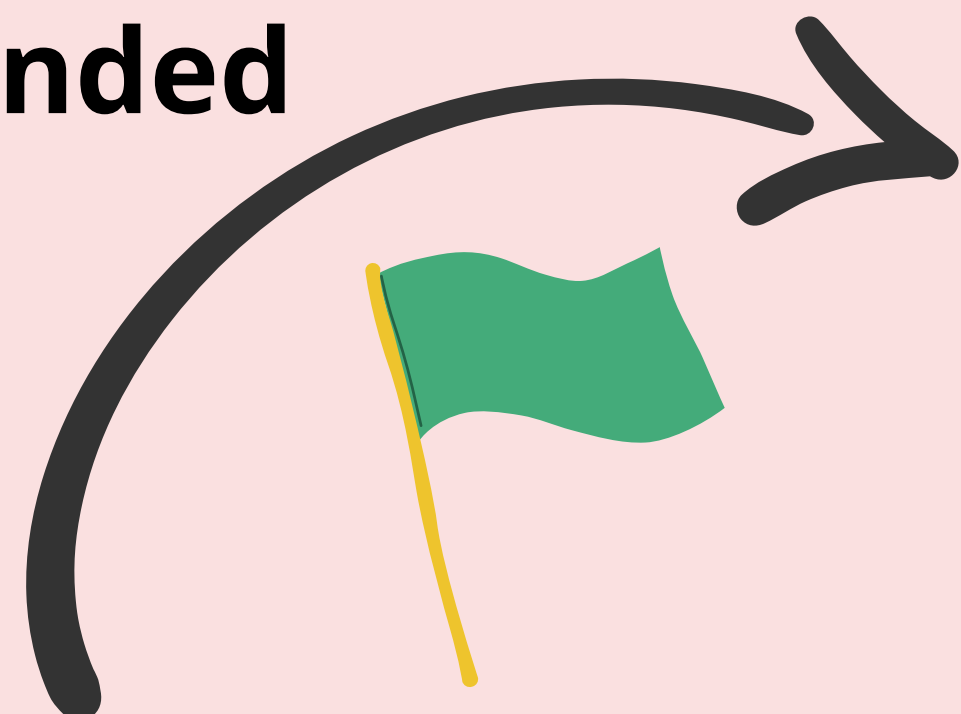
Ainé Fernández Gregorio
Bases de Datos No Relacionales

2021 Abu Dhabi Grand Prix

Lap 53/58



Safety Car
Ended



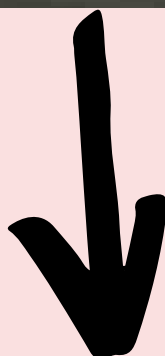
Lap 58/58



Safety Car

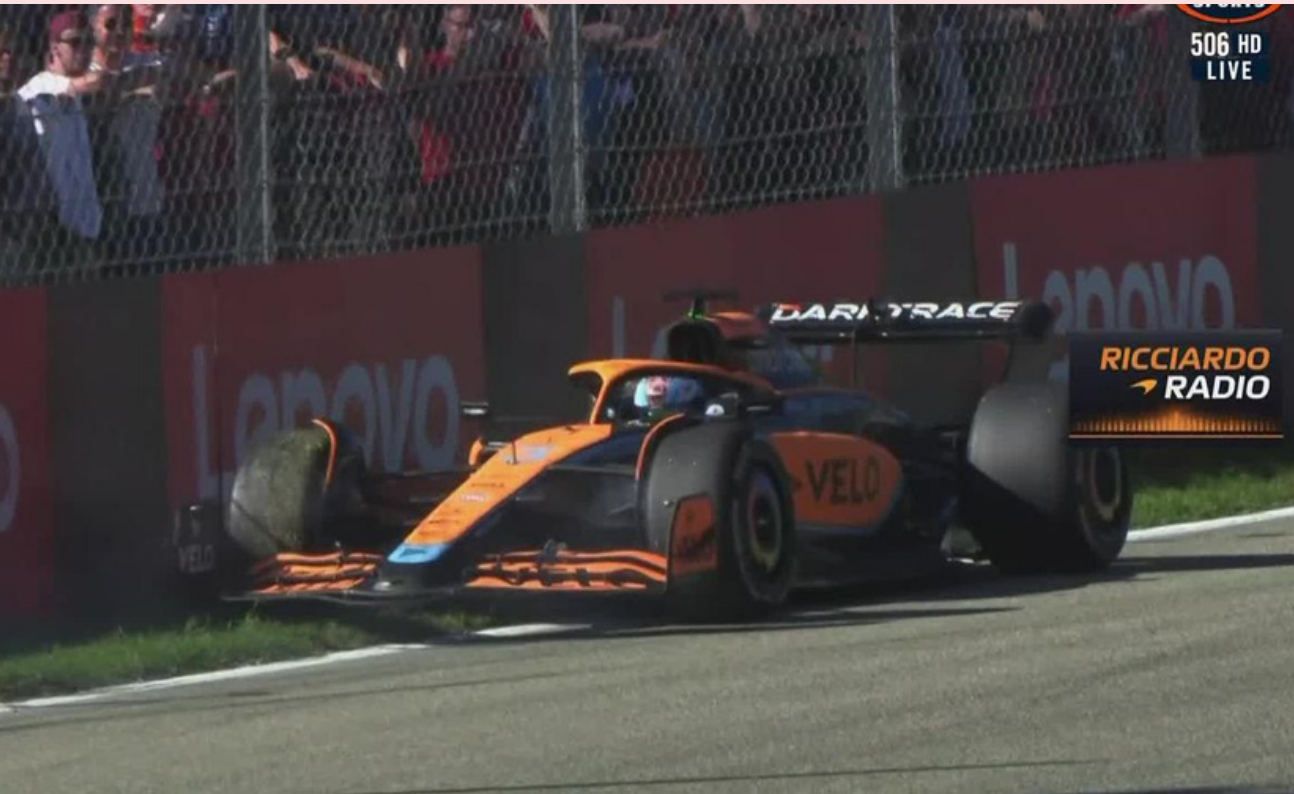


Lap 57/58



2022 Italian Grand Prix

Lap 47/53

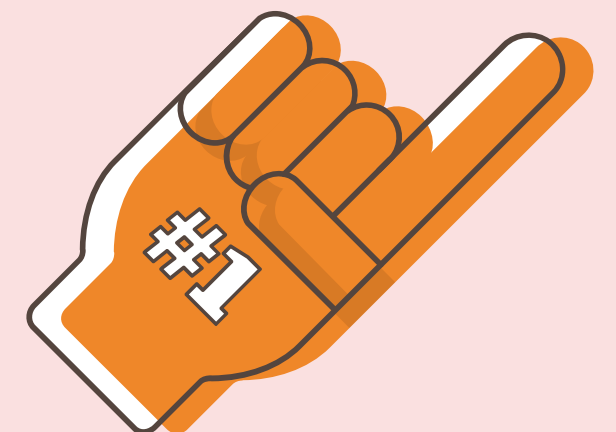


Race ended
behind the
Safety car

Lap 53/53



Safety Car



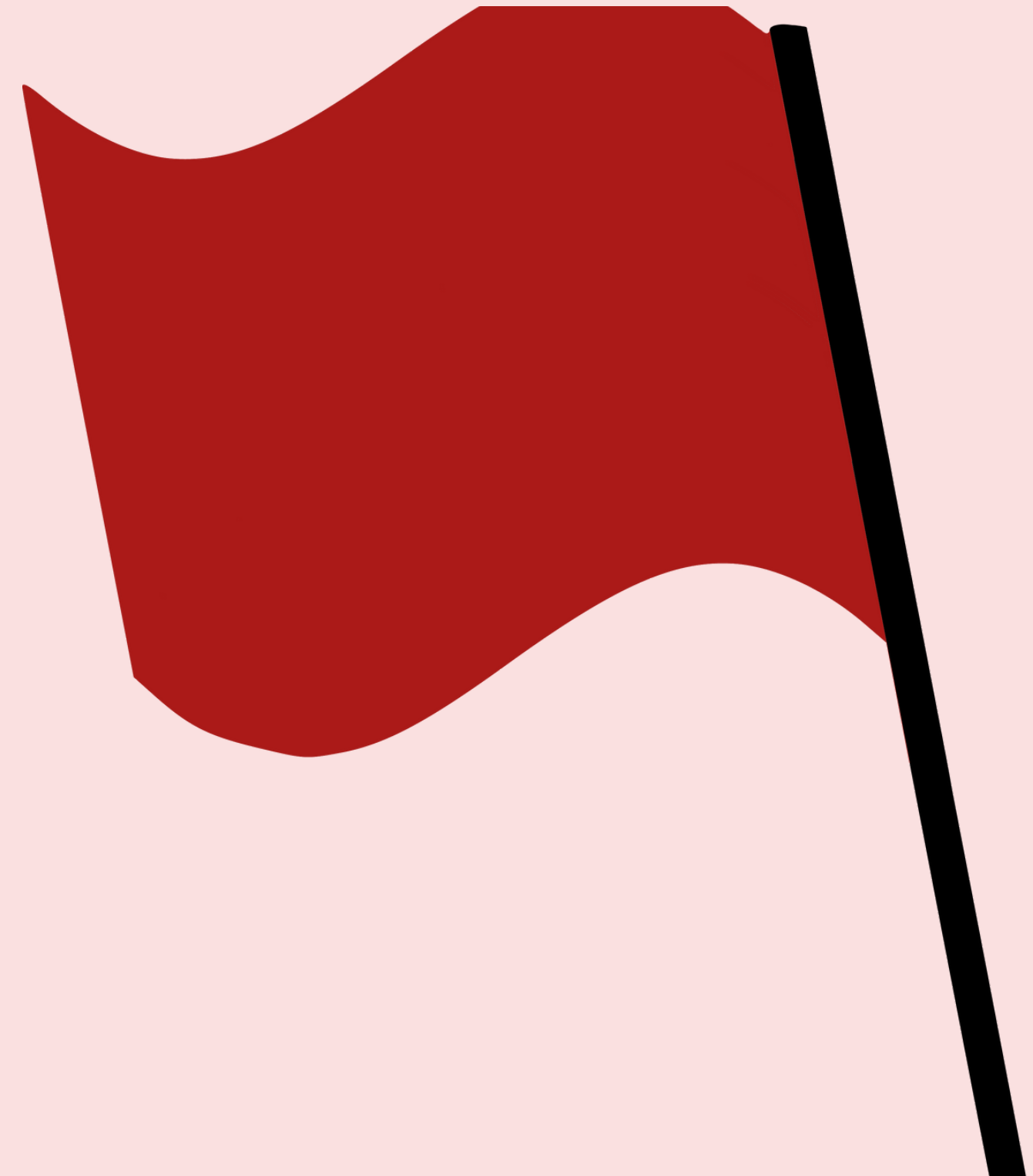
Solution?

RED FLAG

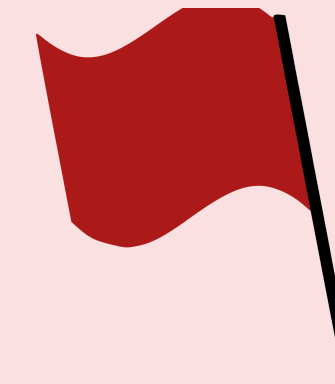
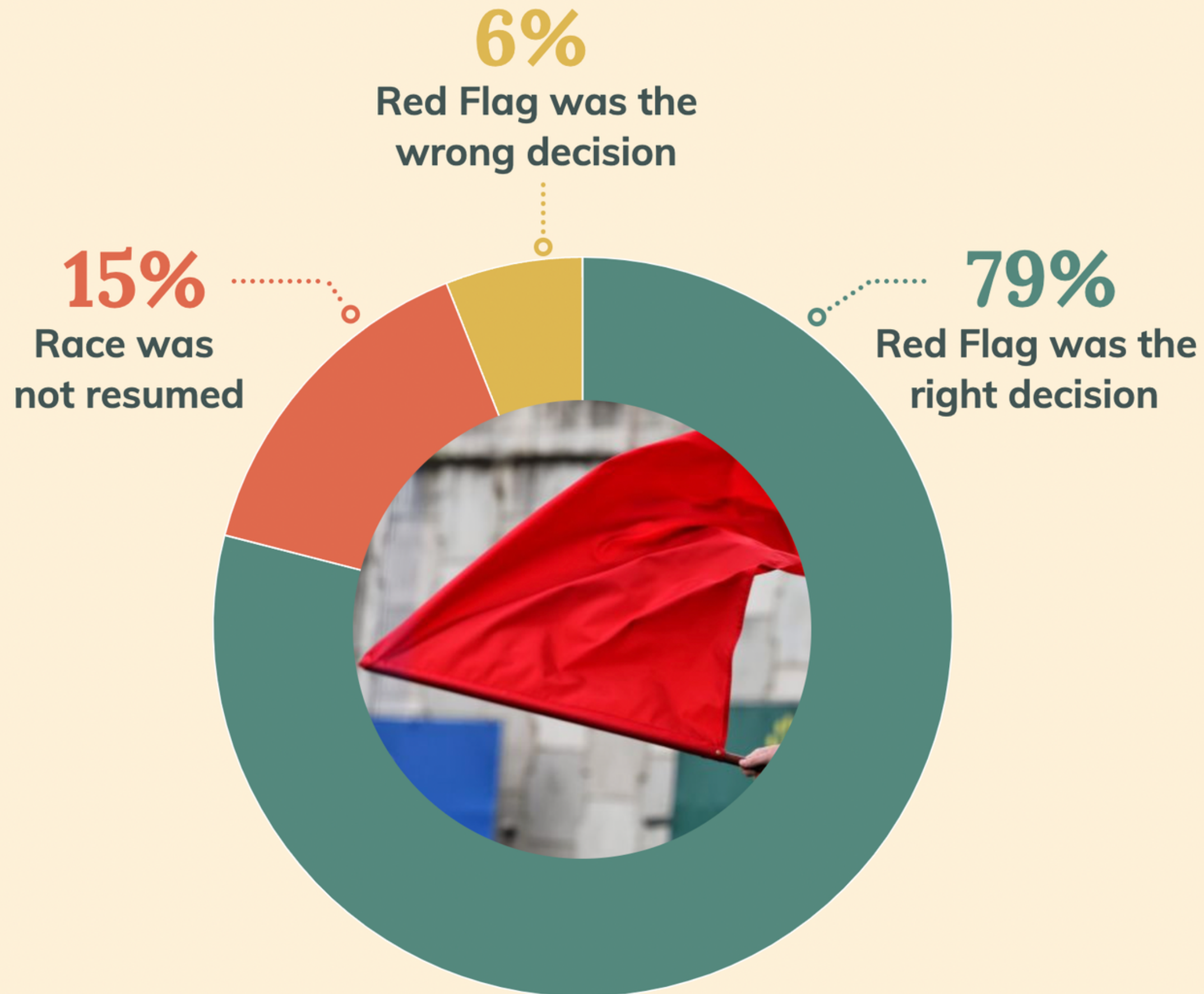
Race is stopped until the track is clear and resumed with the remaining laps

Benefits:

- Safety of drivers and marshals
- No laps are lost



Red Flags in F1

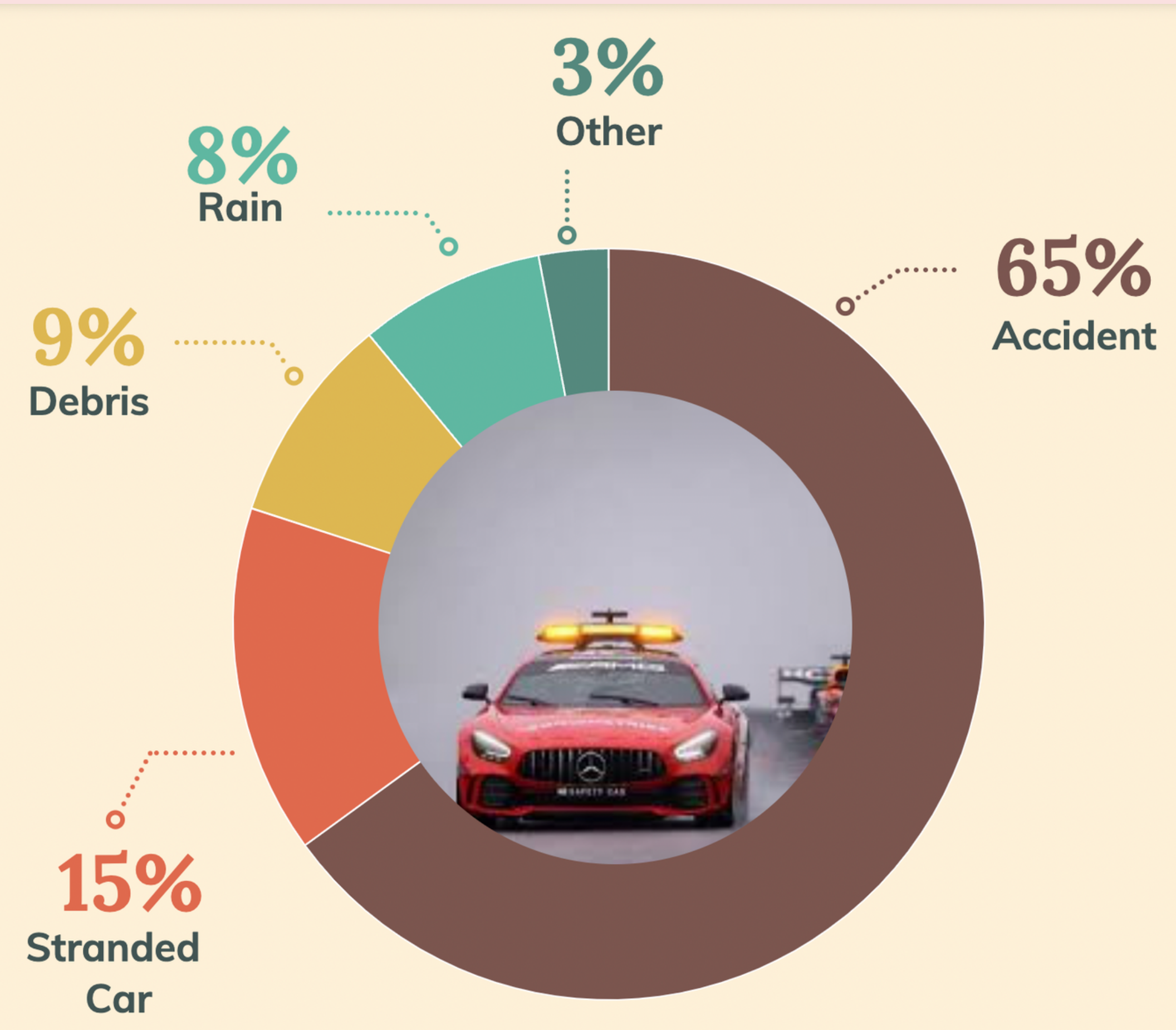


Total Red Flags:
86

Criteria:

Laps behind the safety car
exceeded 30% of the race
or
The race would have ended
behind the safety car

Safety Cars in F1



Total Safety Cars:
303

Analysis







- 1 Average of laps lost behind the safety car at each circuit
- 2 Divide the circuits into three groups (low, medium and high) depending on the average lost laps
- 3 Given the circuit, type of incident and the number of laps left determine if it is better to red flag the race instead of a safety car so that the race has at least 2 racing laps

Circuit type










Low: (1-3.4)

-  Melbourne Grand Prix Circuit
-  Spa-Francorchamps
-  Bahrain
-  Silverstone
-  Autódromo Hermanos Rodríguez
-  Hungaroring
-  Yas Marina

Medium: (3.4-3.8)

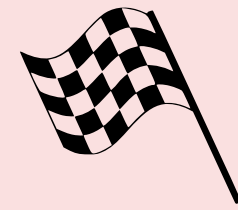
-  Red Bull Ring
-  Baku City Circuit
-  Circuit of the Americas
-  Autodromo Enzo e Dino Ferrari
-  Shanghai
-  Circuit Gilles Villeneuve

High: (>3.8)

-  Jeddah Corniche Circuit
-  Circuit de Catalunya
-  Marina Bay
-  Interlagos
-  Miami
-  Circuit de Monaco
-  Suzuka
-  Zandvoort
-  Monza

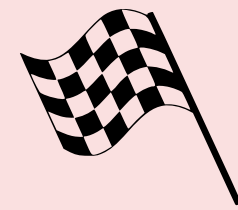
Model

	CircuitType	CauseType	Parameter
0	1	A	2.92
1	1	O	2.50
2	2	S	3.75
3	2	R	6.50
4	3	A	4.04
5	2	A	3.45
6	2	O	5.00
7	2	D	3.10
8	1	R	3.70
9	3	O	5.00
10	3	D	4.67
11	3	S	3.57
12	1	D	3.14
13	3	R	7.19
14	1	S	2.67

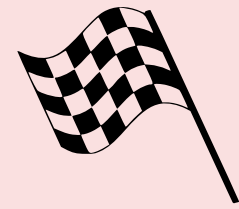


The model receives:

- Circuit
- Type of incident
- Number of laps till the end of the race



The number of laps lost behind the safety car is modeled through a Poisson Distribution

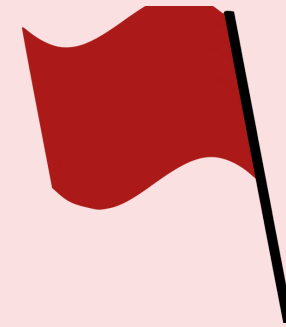


If there is not 90% of probability that the race will have at least 2 more racing laps, then the model recommends a Red Flag

When to Red Flag?

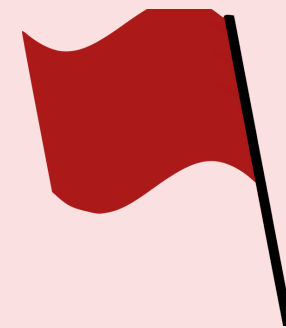
Type 1 Circuits

Melbourne Grand Prix Circuit
Spa-Francorchamps
Bahrain
Silverstone
Autódromo Hermanos Rodríguez
Hungaroring
Yas Marina



When there are 6
laps or less for:

- Accident
- Debris
- Stranded Car
- Other



When there are 7
laps or less for:

- Rain

When to Red Flag?

Type 2 Circuits

Red Bull Ring

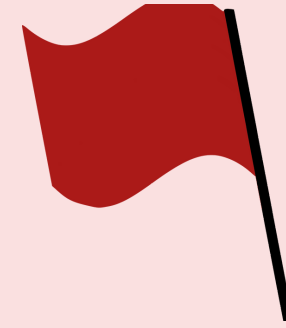
Baku City Circuit

Circuit of the Americas

Autodromo Enzo e Dino Ferrari

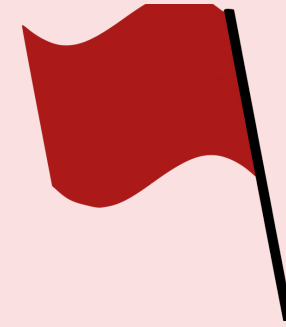
Shanghai

Circuit Gilles Villeneuve



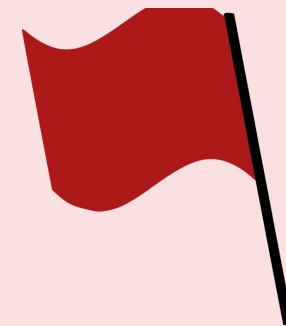
When there are 6 laps or less for:

- Debris



When there are 7 laps or less for:

- Accident
- Stranded Car



When there are 9 laps or less for:

- Rain
- Other

When to Red Flag?

Type 3 Circuits

Jeddah Corniche Circuit

Circuit de Catalunya

Marina Bay

Interlagos

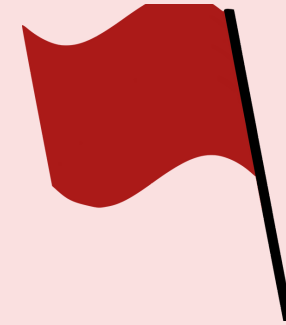
Miami

Circuit de Monaco

Susuka

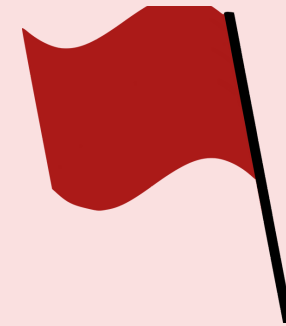
Zandvoort

Monza



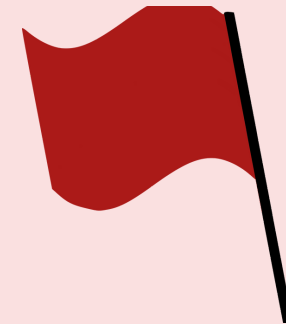
When there are 8 laps or less for:

- Accident



When there are 9 laps or less for:

- Other
- Stranded Car
- Debris

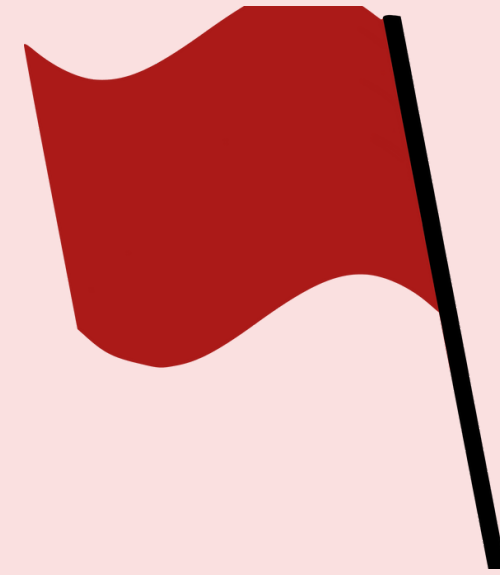


When there are 10 laps or less for:

- Rain

2021 Abu Dhabi Grand Prix

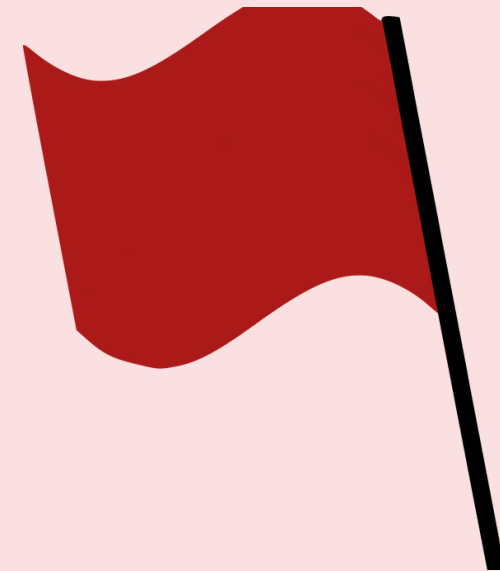
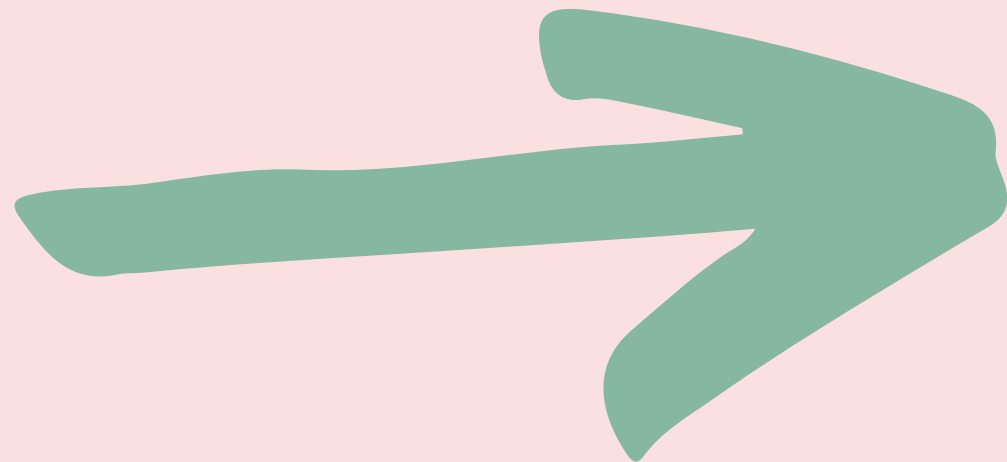
Lap 53/58: Accident
6 laps to go



RED FLAG

2022 Italian Grand Prix

Lap 47/53: Stranded Car
6 laps to go



RED FLAG