

How essential are the use of roll cages in modern day rally cars?

David Kieran James

2103800

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ACADEMIC SKILLS

ACHA4005

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Introduction

In today's highly intense world of modern-day rally racing high speeds, challenging terrains and unpredictable conditions are a regular, this means the roll of safety equipment is mandatory and cannot be overlooked. Among some other safety features the roll cage is the most fundamental, this vital piece of equipment is designed to protect both drivers and co drivers in the case of an incident. The rally world has evolved and completely changed over the last 50 years with the focus set on driver safety, roll cages are the main safety feature within the rally car and the materials used over the years have been modernised along with the cars. The aims of this report are to highlight how essential this safety device is within rallying and justify their integral role to ensure safety for anyone within the vehicle by examining the evolution of roll cage technology and assessing real scenarios and comparing how the vehicle is affected with a roll cage and without in the highly demanding modern-day rallying.

Background

History of Roll Cages

Roll cages in the 60's were considered not to be an essential in rally cars as they would hinder the speed of the cars and would affect how the car would be able to handle, for many drivers and co drivers this decision would be a fatal one, from 1959 to 1970 22 racing drivers were killed due to the vehicle flipping and crashing. These incidents then led the FIA to make roll cages a compulsory safety feature to compete in any form of professional motorsports. (Metrosteel, 2017). The most famous form of rallying was Group B, these cars were built to be fast, and the safety features were not what they are today. The roll cages were built to be as light as possible by using aluminium roll cages, these roll cages were not as effective due to them not being able to withstand a big hit, according to (Auger J, 2016) these regulations were in place from 1982 – 1985, the FIA then prohibited aluminium roll cages as the roll cages were deemed not to be safe enough for drivers after the death of Attilio Bettega where his Lancia 037 cage was not strong enough and on impact the car was completely destroyed on the driver's side, he was killed upon impact. (UPI Archives, 1985)

(Image (1) of Attilio Bettega's Lancia 037 below)



The Development of Roll Cages

After aluminium roll cages were prohibited the introduction of two new stronger and more advanced materials were introduced, these were high strength steel and chromoly. These materials are used for their high tensile strength and their light weight, chromoly is an alloy that's made with chromium and molybdenum. The development of roll cages has also been improved by the introduction of Computer Aided Design as well as simulation tools which give accurate readings and data to designers, so they are able to make the roll cages as safe as possible whilst also minimizing the impacting on the car's overall performance and weight within the FIA regulations (Mitchell, Pete, 2020)

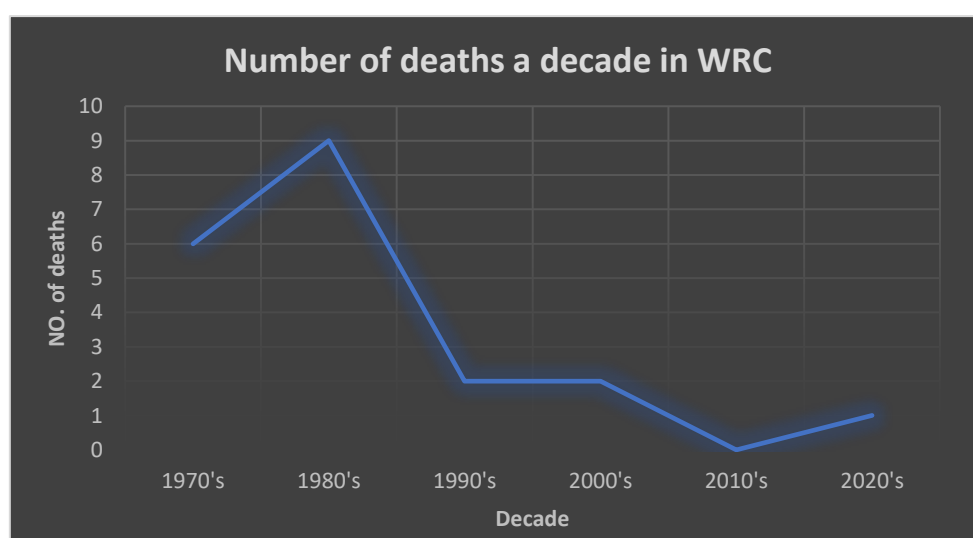
(Image (2) Image of a redbull rollcage in a Volkswagen Polo WRC)



Discussion

Roll cages are considered as one of the most vital components within the rallying, they are a symbol of safety and confidence within the vehicle and sends a powerful message to everyone that safety is a number 1 priority, with any cars these drivers are full of confidence and understand they can push themselves to the limits knowing they are going to be as safe as possible in the case of an incident, this is supported when Welsh WRC driver Elfyn Evans stated in an interview that “if the car is rolling than at least it’s still moving and you know the safety cell 99% of the time it will do its job” (Mobil 1 The grid, 2020) .Within the same interview that was done with Welshman goes on to talk about that the teams and the FIA are always trying to improve safety for the drivers, He goes on to talk about the biggest component in the “safety shell is the roll cage”, he then goes on to specify that the driver & co drivers are now sat more in bound so that the roll cage can protect them as much as possible in the event off an incident. .

Roll cages are ever evolving, currently they are made from chromoly steel which in the current day has a good strength to weight ratio. Characteristics are that it can be efficiently hardened with work or heat treatment processes it is also renowned for its tensile strength which makes it perfect to use in rally roll cages (Metals4U, 2023), as this allows the design teams to optimise the safety of the structure of the car due to the materials easy to work with nature. The development of the safety equipment and regulations that surround the WRC can really be recognised when comparing the death toll over the last 60 years. The graph below shows drivers deaths per decade, and we can clearly see when the “group B” era came to an end in 1986 and safety became a bigger priority and stricter regulations were put in place the death toll fell significantly, even dropping as low as zero deaths within the WRC between April 2006 and early April 2023. (R, Sabirili, 2020)



Advances in roll cage design have not only made the cars safer but also improved the handling performance of the cars due to the torsional rigidity that comes with strengthening the body shell of the car. Roll cages can be bolted in or welded into the cars, with professional rally they must be seem welded into the different points on the vehicle, these include;

- Main roll bar which is welded behind the front seats of the vehicle and are welded to the rear arches of the vehicle inside the car
- Front roll bars which protect the A pillars and the top of the roof by the windscreen
- Door bars which are normally welded in a cross pattern and low to the door to protect from side impacting crashes
- Dash roll bar which goes under the dash of the vehicle

(historic car register, 2023)

(Image (3) Esapekka Lappi crash Chile 2023)



As we can see from the image above (3) the impact these drivers have when they crash are catastrophic, if roll cage technology had not evolved as it had this is one of the many crashes that could have been fatal, these technological advancements save so many lives every year and the importance of roll cage can also be shown again with the YouTube video from

Carmighty called “Rollcage vs No Rollcage Crash Testing” where they test car with roll cages to cars without and every test they did you can see the immense difference the roll cage will have on the survivability in the event of a crash or many other scenarios. (Carmighty , 2020)

With technological advancements continuing to develop we can only imagine what developments we will get in the future to ensure the safety of the drivers and what improvements the roll cage is able to do for the cars and drivers when it comes to handling and precision of the cars to give them the most competitive advantages they can.

Conclusions

As it has been identified this report demonstrates it is essential for roll cages to be used during rallying to ensure the safety to anyone within the vehicle. In the world of rallying where split second decisions can have extraordinary and potentially devastating effects, driver safety is at the upmost importance and the roll cage is a must, in today's modern rallying with all advancements made to the cars the roll cage should be a non-negotiable safety feature that any rally car competing in any event should have. With all the challenges that the drivers face every rally and the constant risk of rollovers and crashes the roll cage is the most effective safety feature in the vehicle due to it strengthen the vehicle structure to shield all those within the vehicle during the high intensity rounds of the WRC and other rallying events around the world.

Reference Page

Auger, Jay. "GROUP B RULES & REGULATIONS." Rally Group B Shrine, 17 Jan. 2016, rallygroupbshrine.org/the-group-b-cars/rules-regulations/.

CarMighty . "Rollcage vs No Rollcage Crash Testing." Www.youtube.com, 22 Mar. 2020, www.youtube.com/watch?v=fZdtvRYudOw.

Metals4U. "What Is Chromoly?" Www.metals4u.co.uk, 2023, www.metals4u.co.uk/blog/what-is-chromoly.

Metrosteel . "The Development of Roll Cage Technology – from Tractors to Racing Cars." Metro Steel, 8 May 2017, www.metrosteel.com.au/the-development-of-roll-cage-technology-from-tractors-to-racing-cars/#:~:text=1959%20%2D1971&text=In%20fact%20between%201959%20and.

Mobil 1 The Grid. "WRC Crashes - the Development of Rally Car Safety." Www.youtube.com, 14 Oct. 2020, www.youtube.com/watch?v=8uq0TTbrGA8.

R, Sabirli. "Evaluation of Accidents and Injuries in International Rally Organizations Held in Turkey." Www.clinmedjournals.org, 13 Feb. 2020, www.clinmedjournals.org/articles/ijccem/international-journal-of-critical-care-and-emergency-medicine-ijccem-6-096.php?jid=ijccem, https://doi.org/10.23937/2474-3674/1510096.

UPI ARCHIVES. "Italian Rally Driver Attilio Bettega Was Killed Thursday When... - UPI Archives." UPI, 2 May 1985, www.upi.com/Archives/1985/05/02/Italian-rally-driver-Attilio-Bettega-was-killed-Thursday-when/7532483854400/.

Historic Car Register . *Technical – Roll Cages – HRCT*. 2023, hrct.co.uk/roll-cages/#:~:text=This%20shows%20a%20full%20roll. Accessed 16 Nov. 2023.

Mitchell, Pete. "A Guide to Roll Cages: Designs and Tubing." JEGS, 30 Aug. 2022, www.jegs.com/tech-articles/building-a-roll-cage-design-tips-tricks/#:~:text=Roll%20Cage%20Material.

Image references

- (1) <https://rallygroupbshrine.org/the-drivers/attilio-bettega/>
- (2) <https://www.redbull.com/gb-en/how-wrc-roll-cage-safety-feature-works>
- (3) https://www.wrc.com/a/news/w26757_BrutarollspellsearlyendforLappisChileambitions