

Engineering Skills Technical Report

Student Name: Benjamin Hinchliffe

Student Number: 2500828



Prifysgol Cymru

Y Drindod Dewi Sant

University of Wales

Trinity Saint David

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Chapter 1: Introduction.

This report covers the topics covered during semester 1 of motorsport engineering, specifically the topics covered in the Engineering Skills module. The topics that will be in this report are Health and Safety following with a relevant risk assessment in chapter 2. Next, in chapter 3 a Security Risk Matrix will be discussed where security threats to the automotive industry will be identified, followed by a response to the highest risk in a professional and engineering related manner. Then what are the roles an engineer plays in society will be discussed in chapter 4 where research will be conducted on the companies that publish code of conducts for engineers. This will then be discussed in terms of what responsibilities engineers take to contribute towards sustainability and environmental issues. In chapter 5 Problem Solving will be discussed in terms of what options engineers can use to solve problems as a team when a problem arises during product development, followed with related flow diagrams. Chapter 6 will then go on to Team structure where a personal review and reflection will be conducted, with what type of team structure was used, and there will be a discussion on how a different type of team structure could have been used. Finally, a conclusion and reference list will tie up this report.

Chapter 2: Health and Safety with Risk Assessment.

An activity undertaken since the start of the motorsport engineering course is changing the front brake pads on a car. Here, health and safety plays an important role as there are many risks to be considered, such as the safety of the axle stands and trolley jack that were used whilst changing the brake pads, the torque specifications for parts such as the calliper slide pins and wheel bolts.

As the vehicle was lifted off the ground during work, specific legislations come into play, for this, Lifting Operations and Lifting Equipment Regulations 1998, also known as LOLER 1998 comes into effect. According to the **Health and Safety Executive, (1998)**, LOLER places duties on people who own and operate lifting equipment, which in most cases falls under Provision and Use of Work Equipment Regulations also known as PUWER. This means that when working with lifting equipment it must be in safe working order and compliant with LOLER and PUWER to ensure the safety of yourself and others. In the case of the task undertaken, both the trolley jack and axle stands were compliant with both LOLER and PUWER with checks taken beforehand to ensure safe working use.

Torque specifications must be complied with when fitting components onto a vehicle to ensure that the vehicle is in safe working order and road worthiness is up to standard / maintained. Using the incorrect torque settings on a vehicle can result in a loss of a life hence why it is so important that they are followed to manufacturer specification. This is a risk that also must be considered, although there is no specific regulation to state what torque settings must be used there are vehicle handbooks and online websites such as AutoData to get the correct specifications.

Task	Hazard	Hazard prevention	Who's at risk	Risk level	Risk Consequence
Lifting of vehicle	Vehicle slipping, jack leakage	Inspected jack, flat ground + handbrake, safe jacking points	Self+others	5	5
Removal of wheels	Trapped fingers, heavy lifting	Avoid placing fingers where wheel can jam, correct lifting posture.	Self	2	3
Removal of brakes and components	Dust + Rust, Cut from sharp edges.	Eye protection, gloves, overalls. Remove rust and dust.	Self	3	3
Cleaning of brakes	Chemical irritation (skin + eye)	Wear gloves, overalls and eye protection.	Self+others	2	4
Refitting of brakes	Incorrect installation – Brake failure	Follow handbook procedure, test brakes at low speed.	Self+others	5	5
Refitting of wheels	Incorrect installation – Wheels come off	Follow handbook procedure, test for wheel wobble	Self+others	5	5

Chapter 3: Security Risk Matrix

To start this chapter, four risks will be identified that are plausible within the automotive industry. The first risk is hacking. This can be in the forms of data leaks, ransomware, or even control over the vehicle itself. A brilliant example of this is the 2014 Jeep Cherokee hacking, where **Greenberg, (2021)** demonstrates how easily a car can be hacked (featuring Charlie Miller, Security Engineer, Twitter, and Chris Valasek, Director of Vehicle Safety Research, IOActive). Greenberg goes on to discuss how Miller and Valasek hack the car from miles away from the car itself and control it (As documented in Fig. 1). From the video, the hackers turn on the AC, turn up the stereo volume, use the wipers and turn off the engine as Greenberg is on the highway. This example shows the extreme dangers of a weak security system on a vehicle, within minutes, and from miles away the car was taken over from a laptop.



Fig. 1: Photo of Miller & Valasek (Photo © Whitney Curtis for WIRED.com) in Greenberg, A (2021): WIRED - Hackers Remotely Kill a Jeep on the Highway—With Me in It.



Fig 2: Hackers disable the brakes and steer the car into a ditch. **Greenberg, A (2021): WIRED - Hackers Remotely Kill a Jeep on the Highway—With Me in It.**

Another security risk would be insider corporate sabotage for example the 2023 Tesla data leak. As discussed in this publication, data breaches can be critical to the company, and employees “Tesla suffered a major data breach that was orchestrated by two former employees” (**Simpson, 2025, example 1 n.p**). Conducting research from **Simpson (2025)** it was found that over 75,000 employees, and ex-employee's data was leaked to a media outlet from a foreign country, and the information included in the data leak was sensitive data like social security numbers, phone numbers and even names and addresses. This goes to show that even companies may not be safe from their own employees looking to sabotage the company they work for.

Another risk would be a software outage. A good example of this is when CDK Global had been cyber attacked (CDK Global provide software for automotive companies). **Robbins-Early (2024)** Discusses how this cyber-attack caused the halt of production for over 15,000 retailers across North America.

Finally, the last security risk is more physical, being counterfeit parts. According to (**Intellectual Property Office, 2025**) “more than 3,600 potentially dangerous fake vehicle parts worth more than £100,000 seized by officials”. Counterfeit parts are dangerous as they are not up to manufacturer safety standards, may not have been tested and may cause damage to the vehicle and in turn, the driver or anyone who is manufacturing, or working on the vehicle.

Likelihood/Consequence	Minor	Moderate	Major	Severe
Very Likely				
Likely				
Possible		Software Outage	Data Leak/Insider Sabotage	Vehicle Hacking
Unlikely			Counterfeit Parts	
Very Unlikely				

To Prevent the highest risk, which is vehicle Hacking, the vehicle needs to have a strong security architecture and a way to authenticate the data being read and written. This could be done via the vehicle's control units with encrypted and authenticated data. Also, frequently patching software and a strong firewall would help prevent hackers and with these measures would mitigate vehicle exploitation.

Chapter 4: Engineer's role in society

There are many organisations that publish code of conducts, The Institution of Civil Engineers and The Royal Academy of Engineering are two organisations that publish a code of conduct for engineers with contributions to sustainability.

According to **The Institution of Civil Engineers (2025)** they help engineers get qualified and preserve their capabilities to support an infrastructure that is relied on by many. In The Institution of Civil Engineers' published code of conduct there are sections on sustainability and the role an engineer plays towards environmental issues; one being how members of The Institution of Civil Engineers must take care of future generations by looking after what we have now such as the historical and cultural aspects of the world. "The 'public good' includes care and respect for humanity's cultural, historical and archaeological heritage" (**The Institution of Civil Engineers: 1 ICE Code of Professional Conduct, 2025, p. 2**)

The Royal Academy of Engineering also states their contribution towards sustainability, "More than 30 of the researchers we've funded over the past year are working on solutions in areas relevant to sustainability" (**The Royal Academy of Engineering, 'Our Impact', 2025 n.p**). The Royal Academy of Engineering has also discussed the future in terms of sustainability by devising a plan to make a sustainable infrastructure that utilises greener energy, cleaner drinking, and ocean water.

The rules stating that engineers must be sustainable is put in place for good measure. It allows for engineers to compose ideas for energy efficient and emission reducing projects, such as reducing the carbon emissions produced by the motorsport business, and utilising green energy solutions like solar panels, hydro-electric generators, and wind turbines.

Chapter 5: Problem Solving.

Problem solving is an integral part of an engineer's day to day work life process, every component and design must be thought out strategically but even with a well laid out plan, without a doubt a problem will arise. This problem could be as little as a slight discrepancy in tolerancing, or as big as machine failure. An engineering team may try to solve a problem in many ways; brainstorming is an effective approach to problem solving to locate and to devise a solution, finding the root cause and then mapping out all possible problems and solutions is effective, but time consuming.

An alternative method of problem-solving is using the method known as Fault Tree Analysis. This is a flow diagram that is made to analyse an issue and other potential issues by having branches that spread out like a tree's branches would, and each branch opens the potential for a new “and” / “or” path to ultimately determine the root cause. FTA is an effective tool for problem solving by creating a flow diagram which helps plan, and track problem solving. As seen in Fig: 3, The top box is the problem and it then branches off into two potential issues, it could be X, or it could be Y. Then that branches once more, this time into four and the process repeats until the problem is found.

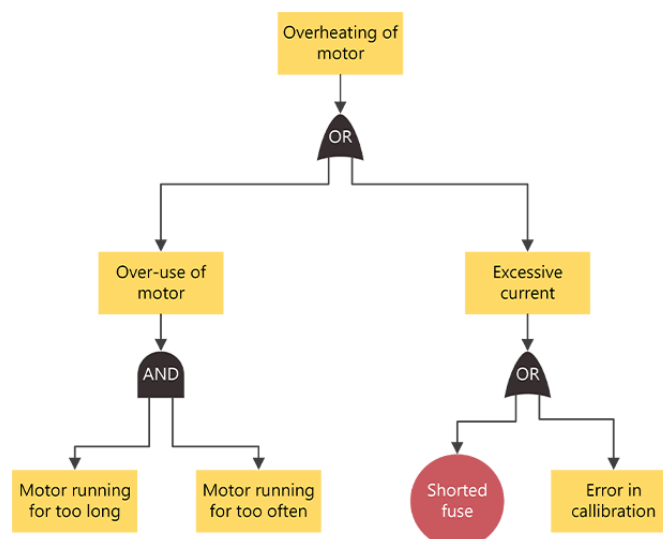


Fig 3: What is Fault Tree Analysis (FTA) **FaultFixers Technologies LTD**
(2025): Fault tree analysis (FTA)

Another method of problem solving would be to use an Ishikawa diagram, also known as a fishbone diagram, as seen in Fig: 4. The fishbone diagram allows an engineering team to brainstorm problems and allocate each potential cause under a category, which then go along the flowchart from left to right, allowing the engineers to come up with a potential solution.

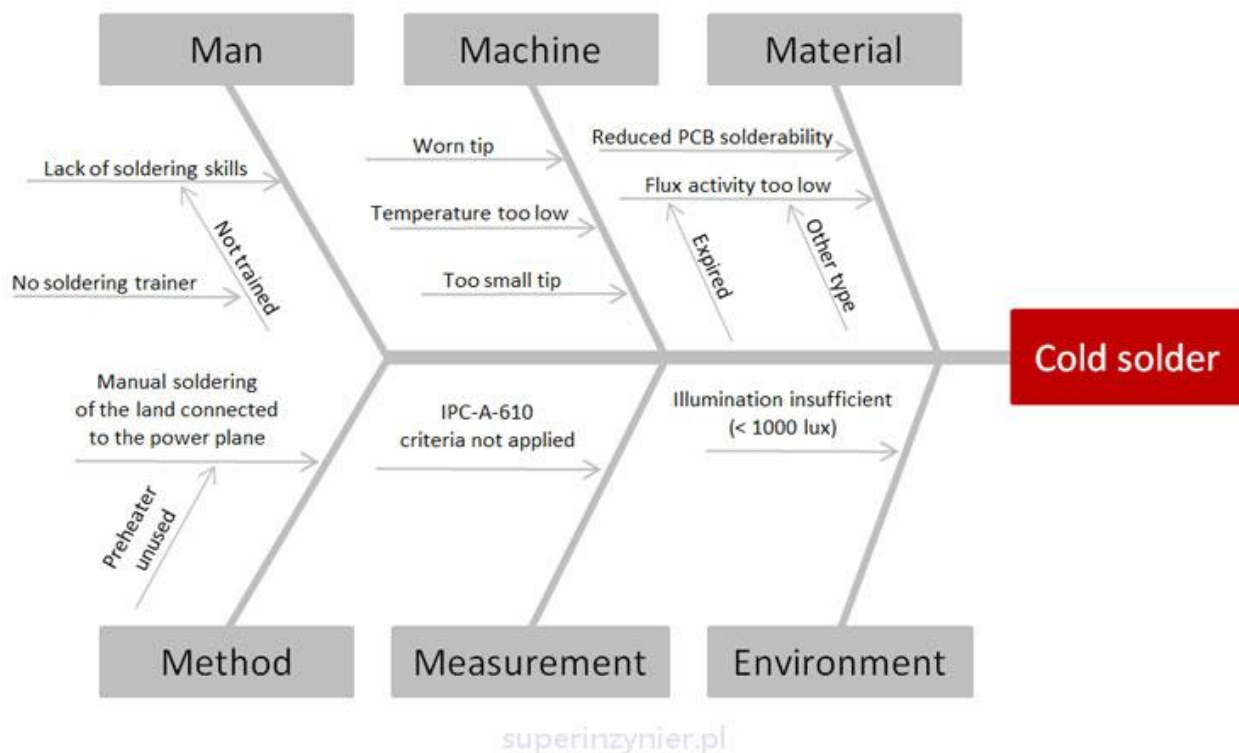


Fig 4: Example of an Ishikawa diagram. **Huber, Z (2023), Super Engineer: Ishikawa diagram**

Chapter 6: Team Structure.

In a previous project in Gower college we, as a class had to fabricate a ramp from metal, we had laying around the engineering workshop. This ramp was built to easily get the college's kit car in, and out the container it was in. The team consisted of 12 of us and we were all assigned different roles. I was a welder, whilst some others were cutting, marking up, measuring and testing. As a team we worked well and communicated effectively. At the time, we were all new to fabrication, so we had some hiccups here and there where we had cut too small, or too big but these problems were easily solved as we all understood each other and effectively problem solved.

Structure Aspect	Positive Aspect	Negative Aspect
Leadership	Our lecturer was our leader, but mostly it was initiative.	Delayed when lecturer was busy e.g. helping someone else or dealing with a matter
Roles	Leader made sure we were competent in roles and most of us were	Some tasks required more than one person which caused delays e.g. cutter had to help welder hold something whilst welding.
Communication	Clear, effective and positive minded when things went wrong	Some team members were quiet and didn't provide much input
Decisions	Ultimately decisions were up to the leader with use of intuition	If intuition can't be followed upon would need leaders' approval which could cause delays as he was rather busy.

Another type of team structure that could have been used is cross-functional teamwork. This is where instead of multiple teams with each a particular skillset; it is multiple teams with different skillsets. This promotes a wide variety of ideas, skills and plans to tackle a task and allows for people to communicate effectively with people on different aspects of a task. For example, an engineer being able to communicate with a designer on the same team, rather than a whole team of engineers trying to communicate with a whole team of designers, which can lead to miscommunication this way is much faster, and much more effective as it is direct and within their team and project.

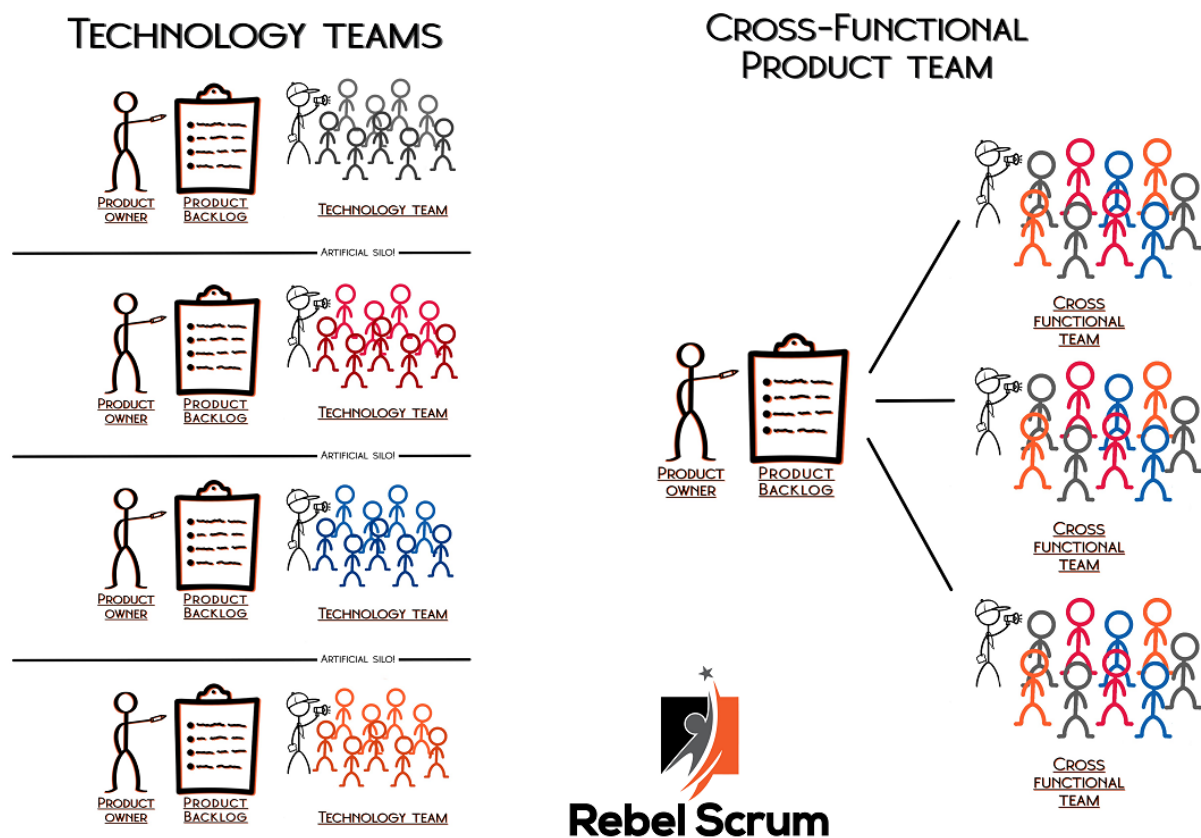


Fig 5: Example of a cross-functional Team. Iqbal, M (2023), Scrum.org: Unraveling the Significance of "Cross-Functional" in Scrum

Chapter 7: Conclusion

This report explored the skills covered in the first semester of the Engineering Skills module with each chapter demonstrating skills and practices a motorsport engineer requires. It emphasised the importance that an engineer follows rules and practices on sustainability, health and safety, risk assessment and management, teamwork, and problem solving to a certain conduct and standard. This was demonstrated via discussions, research, and diagrams with references and citations where appropriate to support the work documented in this report.

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Referenced in chapter 3.

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