

University of Wales Trinity Saint David

Wales Institute of Science & Art



Prifysgol Cymru

Y Drindod Dewi Sant

University of Wales

Trinity Saint David

Engineering Skills Technical Report

Engineering skills (ACHA4022A)

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Contents

1. Introduction.....	1
2. Health & Safety with Risk Assessments Discussion	2
3. Security Risk Matrix	4
4. Engineers' role in society	6
5. Problem Solving.....	7
6. Team Structure	8
7. Conclusion.....	9
8. References	10
8.1 Health and safety with risk assessments discussion.....	10
8.2 Security risk matrix.....	10
8.3 Engineers role in society	11
8.4 Problem solving	11
8.5 Team structure.....	12

1. Introduction

The role of this report is to showcase different aspects and roles involved in engineering, from engineers roles in society to health and safety. This report will include real world examples of teamwork and official practices in relation to development and standards.

2. Health & Safety with Risk Assessments Discussion

While at the UWTSD IQ campus, several tasks have been completed such as workshop lessons involving machining. These lessons consisted of the class being given pieces of steel, then using machinery such as a lathe and milling machine to shape them into the desired form. To operate the lathe according to the NOS you must:

- Isolate machine, fit guards, secure workpiece, ensure tools are clear.
- Avoid hazards from rotating parts, hot chips, and sharp edges with guards and PPE.
- Wear overalls, safety glasses; tie back hair; remove jewellery.
- Know and test emergency stops/brakes.
- Use controls correctly; know normal/emergency stops and restart steps.
- Plan using drawings; select tools, materials, work holding, and checks.
- Read engineering drawings, symbols, tolerances.
- Know lathe parts and accessories.
- Mount work holding/devices safely; avoid distortion.
- Check tools, minimise overhang, understand backlash.
- Use correct speeds, feeds, fluids.
- Measure and inspect accurately; resolve defects; leave area safe.

Potential Hazards	Risk	Actions in place
Loose/ flying debris	Cuts, eye injury, burns	PPE such as safety glasses and coverings. Standing to the side of the cutting tool.
Dropping workpieces/ tools	Crushed digits	Steel toe cap boots
Getting caught in the lathe	Friction burns, crushing, amputation and death	Emergency stop systems. Supervision. No loose clothing/ hair allowed.
Cutting tools and sharp edges	Cuts and lacerations	To clean cutting tools you must use a brush. Maintain care while handling sharp objects.

The risk levels in operating a lathe are high. while the probability of major incidents occurring are low, the severity of the incidents can be fatal. Such incidents can include getting caught in the machine and severe cuts from sharp edges. There as also smaller risks such as dropping work pieces and scratches from swarf. Due to this fact there are many safety features are built into the machines. As well as this multiple pieces of PPE are also required to operate the machine. The apparel required are safety goggles, steel toe cap boots and overalls/ lab coat.

3. Security Risk Matrix

Autonomous vehicles (AV's) are vehicles which do not require the input of a driver.

Driving is already a dangerous activity with many risks, but with the rise of AV's new risks have become apparent due to the new technology. One of these is the risk of an external cyber-attack, this can transpire in multiple ways from things such as changing directions on the GPS to taking direct control over the vehicle. A second risk of AV's is their ability to handle adverse weather conditions. While a human may be able to detect hazardous conditions and act accordingly, an AV may struggle with situations that they are not designed to detect such as icy roads and standing water, even if detected it is likely that the AV wouldn't act in time or accordingly to the situation. AV's also struggle with unpredictable situations such as roadworks; weather this be an inability to detect the obstacles or handle them suitably. This can result in the car colliding with objects and people. Lastly is the risk to cyclists, especially in rural areas where there are lots of twists and blind corners. AV's have demonstrated difficulty to detect cyclists with confirmed deaths from such accidents already being reported.

		Impact →				
		Negligible	Minor	Moderate	Significant	Severe
Likelihood ↑	Very Likely	Low Med	Medium	Med Hi	High	High
	Likely	Low	Low Med	Medium	Med Hi	High
	Possible	Low	Low Med	Medium	Med Hi	Med Hi
	Unlikely	Low	Low Med	Low Med	Medium	Med Hi
	Very Unlikely	Low	Low	Low Med	Medium	Medium

Figure 1 shows a risk matrix (ARMS reliability)

Using a risk matrix the overall risk level can be determined, firstly the chances of a cyber attack are unlikely but will increase with the number of AVs on the roads. While the chances are very unlikely, the impact of these cyber-attacks could be severe resulting in the deaths of numerous people. For this reason it would be classified as Medium risk.

The next risk is that of adverse weather, due to the high speed and lethal nature of cars the impact would also be severe. Whereas in this case the likelihood would be higher, sitting in the likely category, leaving the classification as high risk. Next is the risk of roadworks where the likelihood is possible. Once again the impact of an accident could be fatal, putting it into severe. This would classify the risk as medium high. The risk for cyclists is very similar to roadworks meaning it is also medium high.

Adverse weather is the highest risk, so to combat this systems such as infrared thermography.

4. Engineers' role in society

Automotive engineers are held to many standards to ensure that they are acting accordingly. Two engineering organisations that hold members to a code of conduct is the Institute of the Motor Industry (IMI) and The Chartered Institution of Highways & Transportation (CIHT). The CIHT specifically mentions the environment and sustainability, with its policies clearly stating that they should “act in accordance with the best principles for the mitigation of environmental harm and the enhancement of environmental quality” (CIHT, 2022, page 2) and “strive to ensure that the uses of natural resources are fair and sustainable, taking account of the needs of a diverse society and promotion of the de-carbonisation agenda” (CIHT, 2022, page 2).

5. Problem Solving

In the event of a problem arising during the development of a project it is important that the issue is identified and fixed. To do this it is helpful to break the process down into four main steps. First is to identify the problem, there are many methods to do this such as the 5 whys or a Fishbone diagram. Secondly it is important to think of solutions to solve the current problem, for this techniques like a morphological box are useful. Third is to fix the current problem, tools like the Pugh matrix can help with deciding the best way to go about it. Lastly you must take a step back and look at what could have caused the problem in order to prevent any future issues. Problems can also be solved using the structure of a flow chart such as issues that have occurred during usage of a lathe.

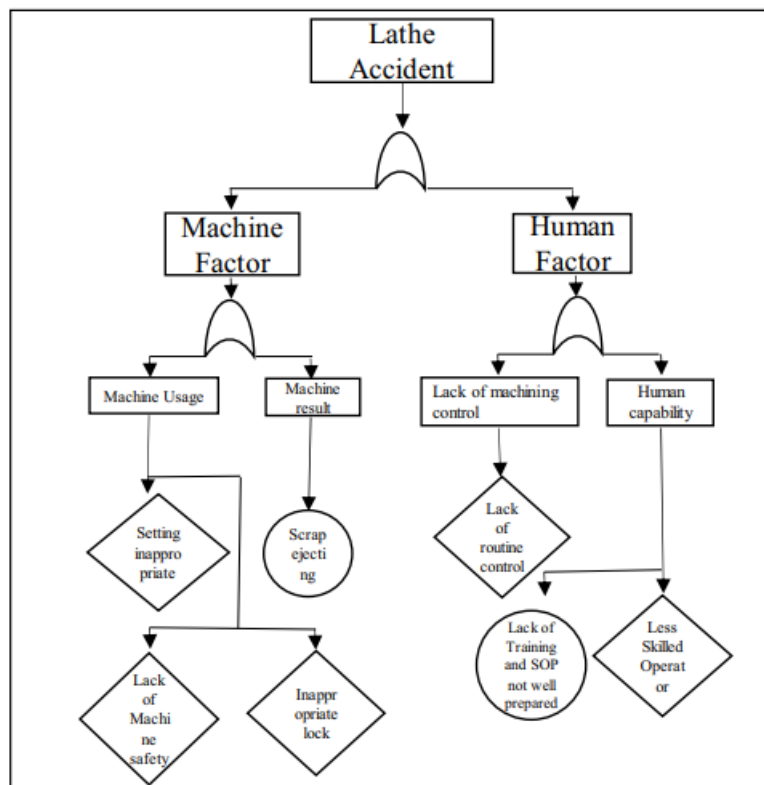


Figure 2 shows a flow chart that handles a problem with a lathe (the electrochemical society)

6. Team Structure

One time I worked in a team in recent memory is a group project I was apart of last year as a part of my studies. The project was to design a soapbox car within the regulations for a real soapbox race. While we were not creating the car physically there was still a lot of work to be done so we split the work between ourselves in the group of 5. By the end of the project we had indeed created what was asked of us, but not to a standard we were proud of. This is down to poor communication and organisation, after we had divvied up the work there was little discussion regarding what we were doing, resulting in many different ideas that often clashed. To mitigate this issue going forward I would appoint a team leader. Team leaders are useful for keeping track of where individuals in the group are when it comes to the project, they can also arrange regular meetings when necessary or even on a regular basis to ensure that the team is heading In the right direction.

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What are the Advantages of Team Leadership?

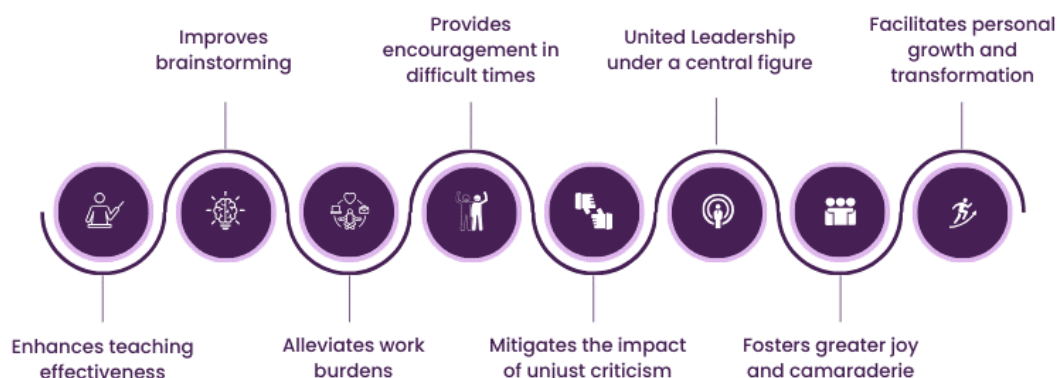


Figure 3 shows multiple advantages of team leadership (theknowledgeacademy)

7. Conclusion

In conclusion this report showcased many aspects of engineering that are important for understanding the role and responsibilities of being an engineer. It can be said that there is a very wide array of topics relevant to being an engineer including Team structures, problem solving and health and safety, all of which was covered in this report.

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8.2 Security risk matrix

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8.5 Team structure

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