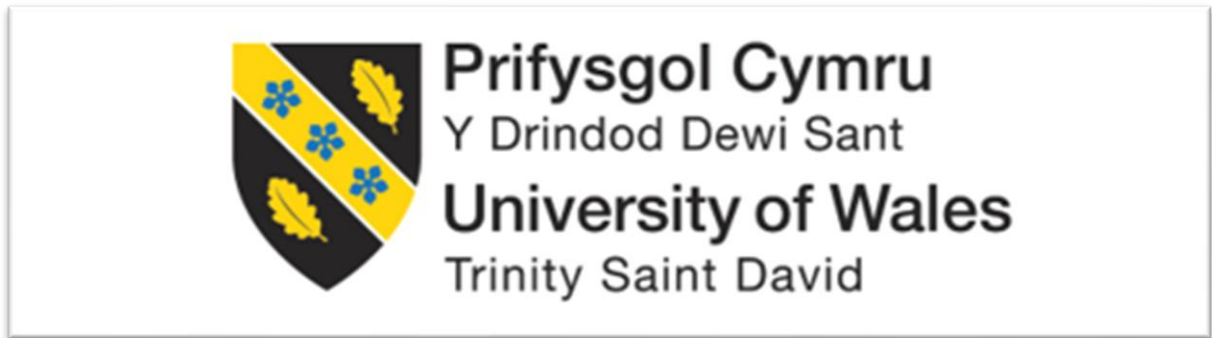


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Prioritised Improvement plan for Forklift Truck Incidents at Blackwood Engineering's
Aberbeeg Site.

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Abstract

At the Blackwood Engineering (BWE) site in Aberbeeg, 68 out of 99 recorded Near Misses across 2023/24 was reported as being caused by a Forklift Truck (FLT) which accounts for 68.69%. To understand the root causes behind this, Quality Tools were utilised for further analysis. A Pareto Analysis was conducted in conjunction with a Measles Chart. The Pareto Analysis illustrated a high frequency of “Lack of Care and Attention” and “Narrow Area” being a root cause of FLT Near Misses. The Measles Chart highlighted the problematic locations around site that caused the majority of the 68 Near Misses. From these results, the corrective actions to be implemented were shopfloor safety briefings and a FLT 360° camera to mitigate the root causes indicated by the Pareto Analysis. To ensure successful implementation of the improvement plan, a target of “Zero FLT Near Misses” will be set with planned solutions to any challenges identified.

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1. Introduction

1.1 Scope of the Improvement Plan

The main aim of this plan is to mitigate the root causes that are responsible for the frequent trend of FLT Incidents at Aberbeeg. This trend accounts for 68.69% of reported incidents in 2023/24 (Appendix A). BWE is a castings and counterweights manufacturing company based in the UK. FLTs play a crucial role at BWE. They help transport raw materials and finished goods. This improves productivity by eliminating manual labour and improving operations. It allows BWE to operate as business by moving key products to its desired department and for logistics and dispatch. A successful improvement plan will reduce the number of FLT accidents and improve the safety conditions at Aberbeeg. This report is based on the two types of FLTs which are used at BWE (Fig 1).



Figure 1: The 3 Tonne (H35D-02) and the 5 Tonne (H50D-600) FLT used at BWE.

1.2 The Importance of Quality Tools in Manufacturing

Utilising quality tools is essential for companies in the manufacturing sector. Companies use these tools to keep their competitiveness over their competitors by improving the manufacturing system's productivity and quality enhancement of the product (Palange and Dhattrak, 2021). By improving product quality, companies can increase profits and expand their customer base. Additionally, enhancing productivity in manufacturing systems can lead to cleaner and more organized workspaces, which can improve health and safety conditions.

1.3 Aims and Objectives

The aims and objectives of this prioritised improvement plan are as follows:

- Understanding the current issues associated with FLTs at Aberbeeg using root cause analysis.

- Applying relevant Quality Tools to analyse areas of improvement for FLT usage at Aberbeeg.
- Develop an implementation plan of proposed improvement changes and their effectiveness to the root causes.
- Understanding the applicability of the proposed implementation changes and challenges such as cost.
- Understanding the key performance Indicators (KPI's) that would outline successful implementation and any potential challenges.

2. Literature Review

2.1 Overview of the Seven Basic Quality Tools

The use of these tools originated from Dr. Karou Ishikawa which he stated were vital for problem solving. Ishikawa stated that the tools if used skilfully, will enable 95% of workplace problems to be solved and intermediate and advanced statistics are needed in about 5% of cases (McDermott et al, 2023). These tools outline the importance of data analysis on a product or process. Not applying the tools early on in a Quality improvement plan can lead to more resources and costs attributed to implementing solutions.

2.2 The Seven Basic Quality tools

These Seven tools are check sheets, histograms, Pareto analysis, cause and effect diagrams, control charts, scatter diagrams, and stratification (McDermott et al, 2023). These tools are a range of graphical techniques which allows anyone regardless of skill, to have the fundamental tools to solve the vast majority of quality related issues (Kiran, 2017, pg. 292). Having these tools readily available is a major advantage. It allows any company the ability to understand any defects within their products and reach a higher level of quality. In a Manufacturing sector, quality is not subject to the product but also for different levels of an organisation such as services, management and personnel (Foivos Psarommatis and Azamfirei, 2024).

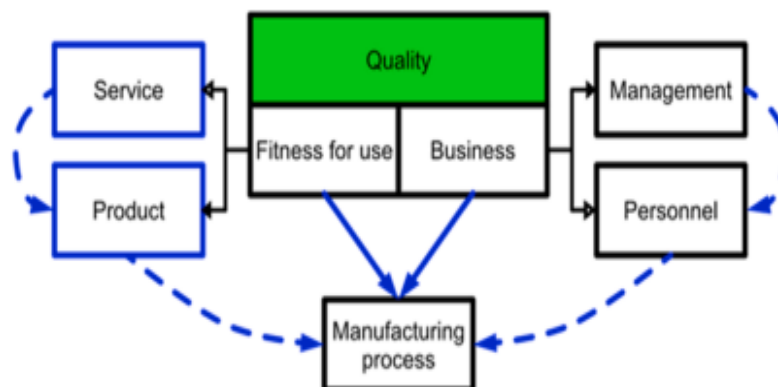


Figure 2: Quality in Manufacturing (Foivos Psarommatis and Azamfirei, 2024)

Figure 2 outlines the various aspects of quality in manufacturing. To obtain what is classed as high quality in manufacturing, each aspect of the illustration must be considered equally and actions taken for continuous improvement.

3. Analysis of Root Causes from FLT Near Misses

3.1 Data Analysed in the Report

At BWE, FLTs are a common occurrence in the health and safety statistics. These instances are recorded as a Near Miss. A Near Miss is an undesired event that had the potential to cause injury, ill health or property damage, but did not (Stockwell Safety, 2017). Near Misses are not specifically mentioned as a requirement to be recorded under UK legislation (Health and Safety at Work etc. Act 1974). However, recording this data is invaluable because it allows companies to monitor how effectively they are managing health and safety in a workplace which is reinforced by the Health and Safety Executive [HSE] (HSE, 2021). At BWE, any instances which fit the category as a Near Miss, are recorded in a paper format.

Report Number (consecutive)

+ Near Miss Record

1. About the person who had the incident

Name _____ Address _____

Postcode _____ Occupation _____

2. About you, the individual filling in this record

If you did not have the incident write your address and occupation.

Name _____ Address _____

Postcode _____ Occupation _____

3. Details of the incident (Continue on the back of this form if you need to)

When it happened: Date _____ Time _____

Where it happened: State location _____

How did the incident happen? _____

Give the cause if possible _____

4. Corrective Actions

What steps should be taken to prevent a recurrence of the near miss incident? _____

5. Sign and date

Person filling in the record:

Print Name _____ Sign _____ Date _____

Person who has had the near miss incident (as confirmation they agree the incident has been recorded accurately):

Print Name _____ Sign _____ Date _____

6. For the employer only

Complete this box if the incident is reportable under the Reporting of Injuries, Diseases and Dangerous Occurrences Regulations 2013 (RIDDOR).

How was it reported? _____

Print Name _____ Sign _____ Date _____

Figure 3: Paper format for reporting a Near Miss

Utilising this format allows analysis of the events from the Near Miss as well as at the time the suspected cause. This is essential as understanding the full version of events is pivotable to understanding what we can class the root cause of the FLT related Near Miss. This allows further statistical analysis to be more accurate as key details have been recorded.

3.2 Root Cause Analysis of FLT Near Misses

To understand the potential issues of FLTs at Aberbeeg, root cause analysis was conducted. A Cause and Effects analysis, also known as a “Fishbone Diagram”, was utilised. Using a Fishbone Diagram is beneficial as it visualises the relationships between all possible root causes and highlights root causes that require data collection (Kumah et al., 2024).

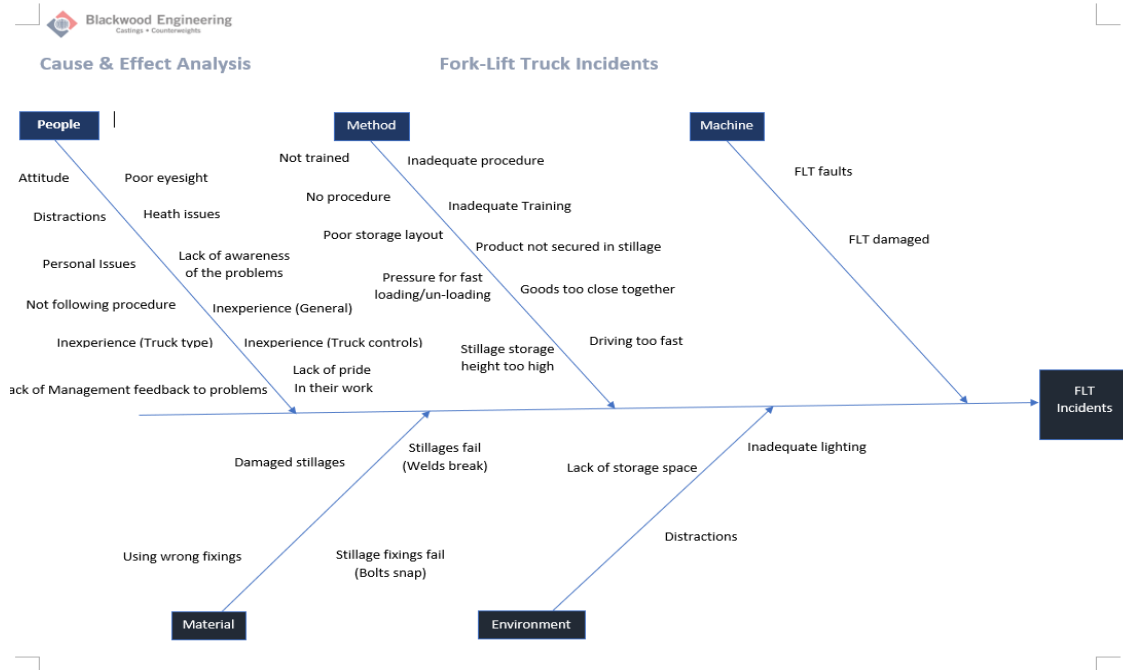


Figure 4: Fishbone Diagram of FLT related Near Misses at BWE.

Figure 4 shows potential causes categorised under five Main headings: People, Method, Machine, Material and Environment. From analysis of Figure 4, there are a number of recorded problems around the “People” and “Method” category. This highlights an initial cause of FLT Near Misses due to the higher frequency of potential causes that have been considered. Understanding where the frequency of causes are higher allows for more critical analysis and more effective corrective actions to be implemented. However, to understand if these potential causes are related to Near Miss data collected at BWE more analysis is need.

3.3 Pareto Analysis of Data

To understand the causes of FLT related Near Misses accounting for 68.69% of recorded Near Misses in 2023/24, Pareto Analysis was conducted. Pareto Analysis is one of the Seven Basic Quality Tools, also known as the 80-20 rule, in which the vital few are identified with significant impact to the trivial many and helps to prioritise corrective action (Patel and Patel, 2021). Pareto Analysis was chosen as it will help to make informed decisions and prioritise the appropriate interventions to achieve the desired goal (Alkiayat, 2021). This will allow implemented corrective action to be effective by mitigating the highest frequency root causes.

3.4 Pareto Analysis of 2023

Near Miss data from 2023 at Aberbeeg was first stratified into Near Misses that were FLT related. This resulted in out of the 41 recorded Near Misses for 2023, 31 were FLT related (Appendix A). In total, of all collected data for this period, 75.61% of Near Misses were attributed to FLT.

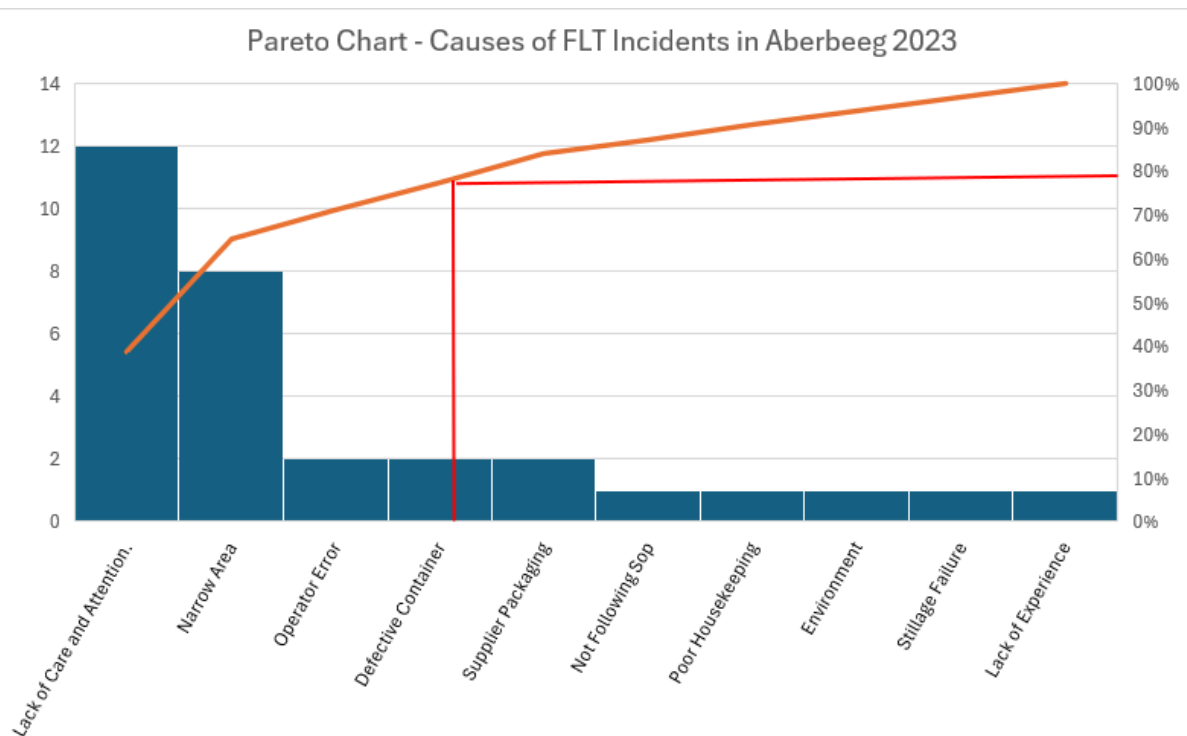


Figure 5: Pareto Analysis of FLT Near Misses at Aberbeeg in 2023.

Figure 5 shows the reported causes of the 31 reported Near Misses from Aberbeeg in 2023. Analysing this data, “Lack of Care and Attention” and “Narrow Area” were the highest frequency of causing FLT Near Misses. The 80-20 rule which is the foundation of Pareto Analysis is an observed phenomenon which states that 80% of effects result from 20% of causes (Ofosu-Tuffour, 2024). As seen in Figure 5, a red line highlights what 80% of the 31 reported Near Misses of FLT were caused by. Targeting these causes first would be beneficial than implementing actions for all reported causes. This principle allows more in-depth understanding behind the root causes of problems associated with FLT.

3.5 Pareto Analysis of 2024

Further Analysis of Near Miss data from Aberbeeg in 2024 was conducted using Pareto Analysis. The data was stratified into Near Misses that were FLT related. Out of the recorded 58 Near Misses recorded in 2024, 37 were FLT related (Appendix A). This accounts for 63.79% of all the Near Misses in 2024. Although the percentage of FLT related Near Misses has decreased from 2023, the number of incidents has increased by 6. This shows an increasing trend year by year.

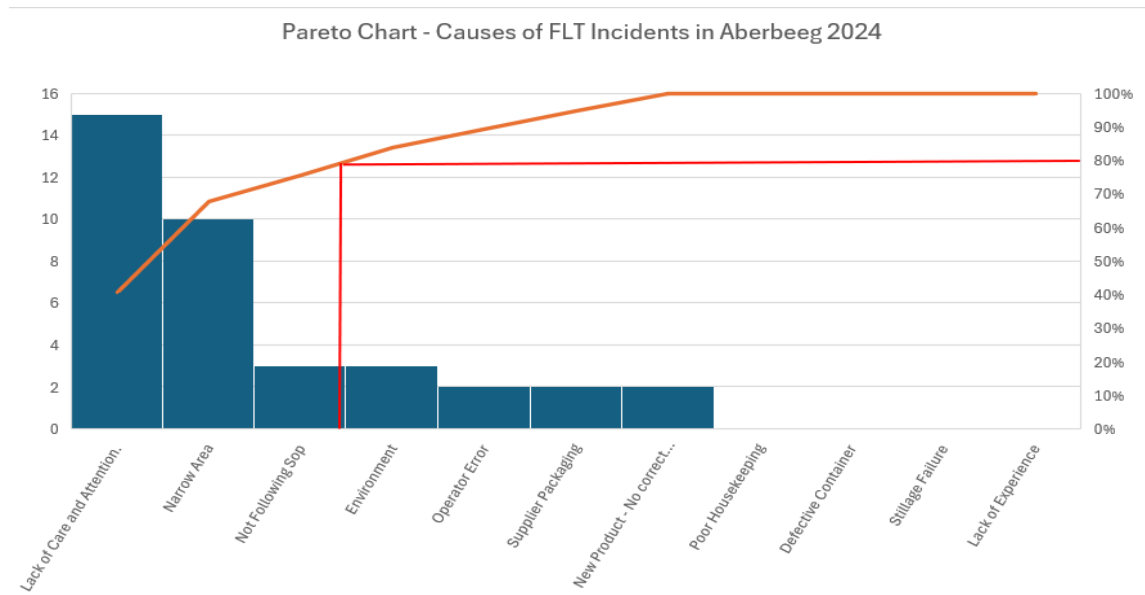


Figure 6: Pareto Analysis of FLT Near Misses at Aberbeeg in 2024.

Figure 6 highlights that “Lack of Care and Attention” and “Narrow Area” were the highest frequency of reported causes of FLT Near Misses. This is the same trend observed in Figure 5. This indicates that improved corrective actions should be targeted at these root causes. From observing the trend over 2023/24, its increasingly likely the trend will continue with the same two highest causes. By using this Pareto Principle, it allows the most prevalent root causes to be addressed first which have the largest impact on reducing FLT Near Misses.

3.6 Overall Pareto Analysis Conclusion

To understand what implemented actions are needed, a further Pareto Analysis was conducted on all the stratified Near Miss data of 2023/2024.

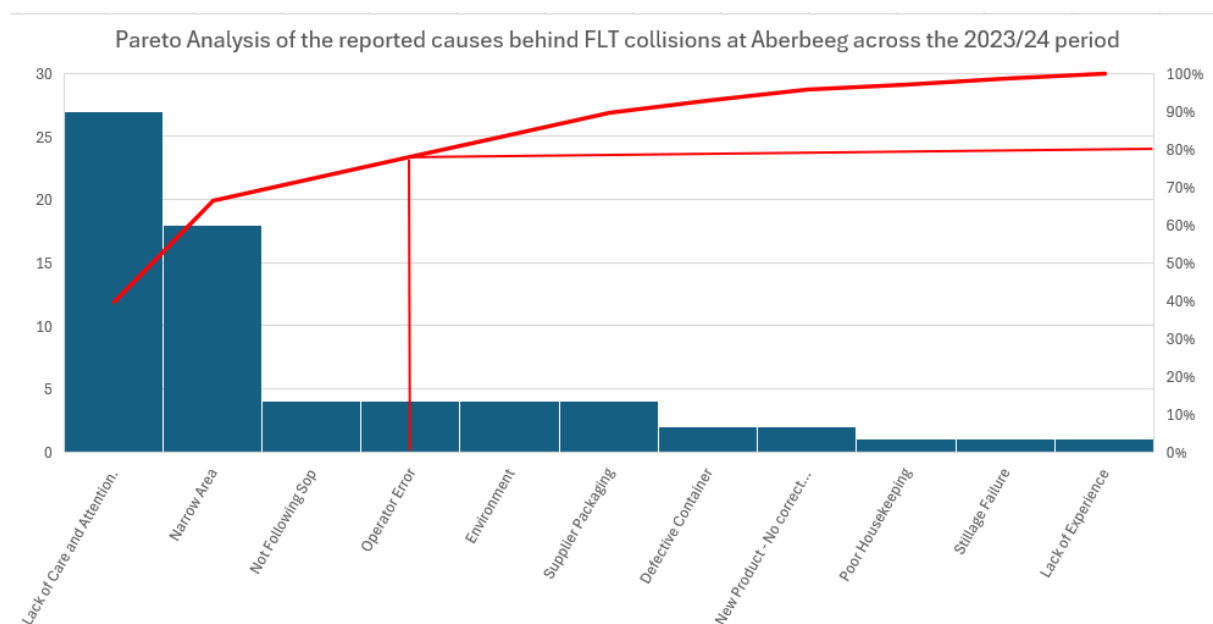


Figure 7: Pareto Analysis of FLT Near Misses at Aberbeeg in 2023/24.

Figure 7 outlines all the root causes behind FLT Near Misses that have been recorded in 2023/24. Following the Pareto Principle, the 20% of root causes, highlighted by the red line in Figure 7, equate to a total of 80% of the 68 FLT Near Misses out of the 99 recorded over two years. Corrective actions that are to be taken, must directly deal with these issues. Pareto Analysis was vital as not understanding the biggest root causes behind this trend would lead to an unsuccessful improvement plan. This is why Pareto Analysis was chosen over other tools due to the qualitative data that describes the root causes of FLT Near Misses.

4. Check Sheet Analysis

4.1 Overview of Check Sheets

For the prioritised improvement plan to be successful, it's important to understand where at Aberbeeg the majority of Near Misses are occurring. To analyse this information a check sheet was implemented in the form of a Measles Chart. Check sheets are valuable because they are a simple form of data collection about the process carried out, determining the number and types of defects (Fuentes et al., 2023).

4.2 Measles Chart of Aberbeeg.



Figure 8: Measles chart of FLT Near Misses at Aberbeeg in 2023/24.

Figure 8 illustrates a layout of the manufacturing site at Aberbeeg that has been utilised into a Measles Chart. Every FLT Near Miss across 2023/24 is indicated by a black pin. As well as this, a heat map aspect was added for more visual analysis. From Figure 8, the Prep Shop has the highest frequency of Near Misses and clusters can be seen all around the site in narrow areas which was indicated in the Pareto Analysis (Figure 7, Section 3.6). This Measles Chart is important as it allows implemented corrective actions to be used in the most effective areas.

5. Corrective Actions

5.1 Regular Shopfloor Safety Briefings

To mitigate the root causes behind FLT Near Misses, regular shopfloor safety briefings are to be implemented. Pareto Analysis (Figure 7, Section 3.6) identified the largest root causes behind FLT Near Misses. A safety briefing can outline these issues to those who are directly involved in FLT operations. This can be considered as vital as routine safety briefings can increase workers' awareness and knowledge of the risks in the workplace (Adi Widyasmoro et al., 2025). These will be conducted as a joint effort with Team Leaders of the shift and the Production Support Engineers that are responsible for health and safety at BWE. The basis of the briefings can be altered to ensure that the 80% of the root causes (Figure 7, Section 3.6) are reiterated to improve awareness as well as recent FLT Near Misses to avoid re-occurrence. Figure 8 (Section 4.2) can also be introduced for further awareness of where the majority of FLT Near Misses are happening for increased awareness of operations that are in proximity. These will be implemented on a weekly basis for increased communication and constant reminders.

5.2 FLT 360° Camera

Another aspect of the improvement plan is to aid the FLT drivers in awareness while in operations. A device that could be used is the “Durite 360° 3D system” which gives the FLT driver a bird’s-eye view of the whole vehicle (Beacons&Lightbars, 2023). This gives the driver the ability to see their proximity to pedestrians and objects while manoeuvring in narrow areas and in frequent hot spots outlined in Figure 8 (Section 4.2). This could be implemented on the fleet of FLTs at BWE (Figure 1, section 1.1) which totals currently to 11 FLTs. Attaching these devices can be done by the Maintenance team. Further training would be required for the FLT operators in the use of the device by the Production Support Engineers.

5.3 Ranking of Corrective Actions

The first step of the improvement plan will be the weekly shopfloor safety briefings. They have minimal upfront costs and can be implemented straight away. Furthermore, the ability to customise the content of these briefings on a weekly basis allows for more awareness of the biggest root causes behind FLT Near Misses (Figure 7, Section 3.6). Having this platform will give more effective communication from FLT drivers which allows more understanding of the root causes and more potential improvement ideas. The second phase of the FLT 360° camera will have a substantial cost for BWE. The upfront cost for this device is £1,387.85 excluding VAT (Beacons&Lightbars, 2023). To implement these on 11 FLTs in total will cost £15266.35 excluding VAT. This is a substantial cost compared to the safety briefings which explains the prioritization of corrective actions. In addition to the upfront cost, the FLT 360° camera has hidden costs of regular maintenance checks and the possibility of future faults. However, its ability to give drivers extra visual aid and awareness to their proximity of pedestrians and objects provides safer working conditions which is vital to the improvement

plan. For the FLT 360° camera to be fully implemented on all 11 FLTs, a period of 3 months will be targeted to include delivery times as well as setting up and training.

5.4 Monitoring of Improvement Plan

To monitor the effectiveness of the corrective actions, key performance indicators (KPIs) will be set up. After successful implementation of the corrective actions, a target of “Zero FLT Near Misses” will be introduced to indicate successful achievement. The fundamental concept behind this KPI is that any future Near Misses will not be FLT related. If any Near Misses including an FLT are reported, the analysed root cause will be communicated in the weekly safety briefings to increase further communication to those effected. This response will help to further reach the set KPI and maintain a safer working environment.

6. Conclusion

6.1 Potential Challenges

Ensuring constant use of the FLT 360° camera and continued effort to the KPI will be a potential challenge to the improvement plan. This can be seen with simple failure of a repeated action, lapses of memory or attention and error of judgement which can be classified as typical basic types of human failure (Stockwell Safety 2017, pg. 22). To mitigate these challenges, frequent refresher training of the FLT 360° camera can be implemented as well as altering the safety briefings to reiterate the use of this device. Implementation of visual reminders can enforce the idea behind the KPIs and daily encourage from management to help improve the safety of the work environment.

6.2 Overall Conclusion

The Quality Tools used in Section 4.2 & 3.6 were beneficial in understanding the root cause behind FLT Near Misses accounting for 68 out of 99 recorded incidents across 2023/24 at Aberbeeg. This analysis was vital in understanding the most successful corrective actions to be implemented which resulted in the regular safety briefings and the FLT 360° camera. Potential challenges to the improvement plan have been identified and methods to mitigate have been identified to ensure a successful implementation of the improvement plan complying with the KPI (section 5.4).

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8. Appendix A

Near Miss data from the BWE site at Aberbeeg, across the time period of 2023/2024.

[Quality and Business Improvement data.xlsx](#)