FACTUAL REPORT

Duty Holder Details: Merlin Attractions Operations Ltd			
Name of Duty Holder	Merlin Attractions Operations Ltd. Trading as: Alton Towers Resort	**Role**	Theme / Amusement Park
Address	Farley Ln, Alton, Staffordshire, ST10 4DB.	**Registered Office**	3 Market Close, Poole, Dorset, BH15 1NQ.
Duty Holder Status	Private limited company	**Companies House No.**	06272935

Introduction and Company Background / Synopsis

Introduction / accident summary

The incident occurred on the Smiler ride at the Alton Towers Resort. On the day of the crash an unoccupied ride carriage had stalled ("valleyed") in the bottom of one of loops (known as the 'Cobra Roll'), in a free fall section of the track called the 'Pit' (or 'Amphitheatre').

The ride's PLC did what it was supposed to do, to safeguard the ride, and halted the trains behind the stalled carriage in 'safe' positions.

One of the halted carriages, immediately behind the valleyed one, contained a full complement of 16 passengers – this was the carriage which eventually was involved in the crash. It was 'block stopped' by the ride's PLC at the crest of Lift No.1.

Engineers attending the Smiler mistakenly thought that the valleyed train was a 'phantom' train caused by a 'hang-over glitch' from a previous fault on the ride. Therefore, two of the electrical engineers, who were in attendance at the Smiler, resolved to undertake a manual reset of the occupied block, to clear the stalled train from the PLC's system (clear the PLC's belief that a block was occupied by a valleyed train).

The engineer performing the track-side reset had not observed the stalled train, nor was it spotted on the CCTV images by the other staff in the ride's control cabin.

The manual reset was completed and the train behind (containing the IPs) was released – it then impacted with the empty valleyed one at the bottom of the 'Cobra Roll' loop.

The accident happened at around 13:51 on 02/06/15.

Company Background / synopsis

Merlin Entertainments is the largest entertainments company operating throughout Europe. Merlin runs 110 attractions in 23 countries. According to their website, they describe themselves as follows:

"We are a company built on fun – a reason why our 59.8 million guests choose to spend their time at our unique attractions. We seek to create magical days out for our visitors and the kind of memories which last forever. We currently have over 22,000 people working in 100 global attractions spread across 22 countries and four continents. We are the second largest attractions operator in the world and the team behind some of the best-known names in global leisure".

The Alton Towers Resort theme park is owned by 'Merlin Entertainments' (Merlin Attractions Operations Ltd) and is widely regarded as one of Britain's leading theme parks.

Within the UK Merlin also owns the following theme parks:
* Chessington World of Adventures
* Thorpe Park Resort
* Warwick Castle
* Legoland Windsor Resort

The Smiler ride (opened in May 2013) was the world's first 14 loop rollercoaster and was labelled by the company as "Alton Towers' latest thrill ride".

Key Witnesses:

[redacted] (Smiler Ride Operator, i.e. at time of incident)
[redacted] (Electrical Maintenance Engineer, attending Smiler ride on day of incident)
[redacted] (Electrical Maintenance Engineer, attending Smiler rid e on day of incident)
[redacted] (Mechanical Maintenance Engineer, attending Smiler ride on day of incident)
[redacted] (Mechanical Maintenance Engineer, attending Smiler ride on day of incident)
[redacted] (Team Leader, Line manager to [redacted] and [redacted]

—

[redacted]

Description of the facts and circumstances leading to the incident including preventative measures taken by the duty holder(s)

The Factual report should be completed for all investigations including, proportionally, curtailed investigations.

Give a factual account of the events leading up to the incident (or ill health condition) and its outcome. Identify and describe any relevant machinery, equipment, substances, workplace and environmental factors.

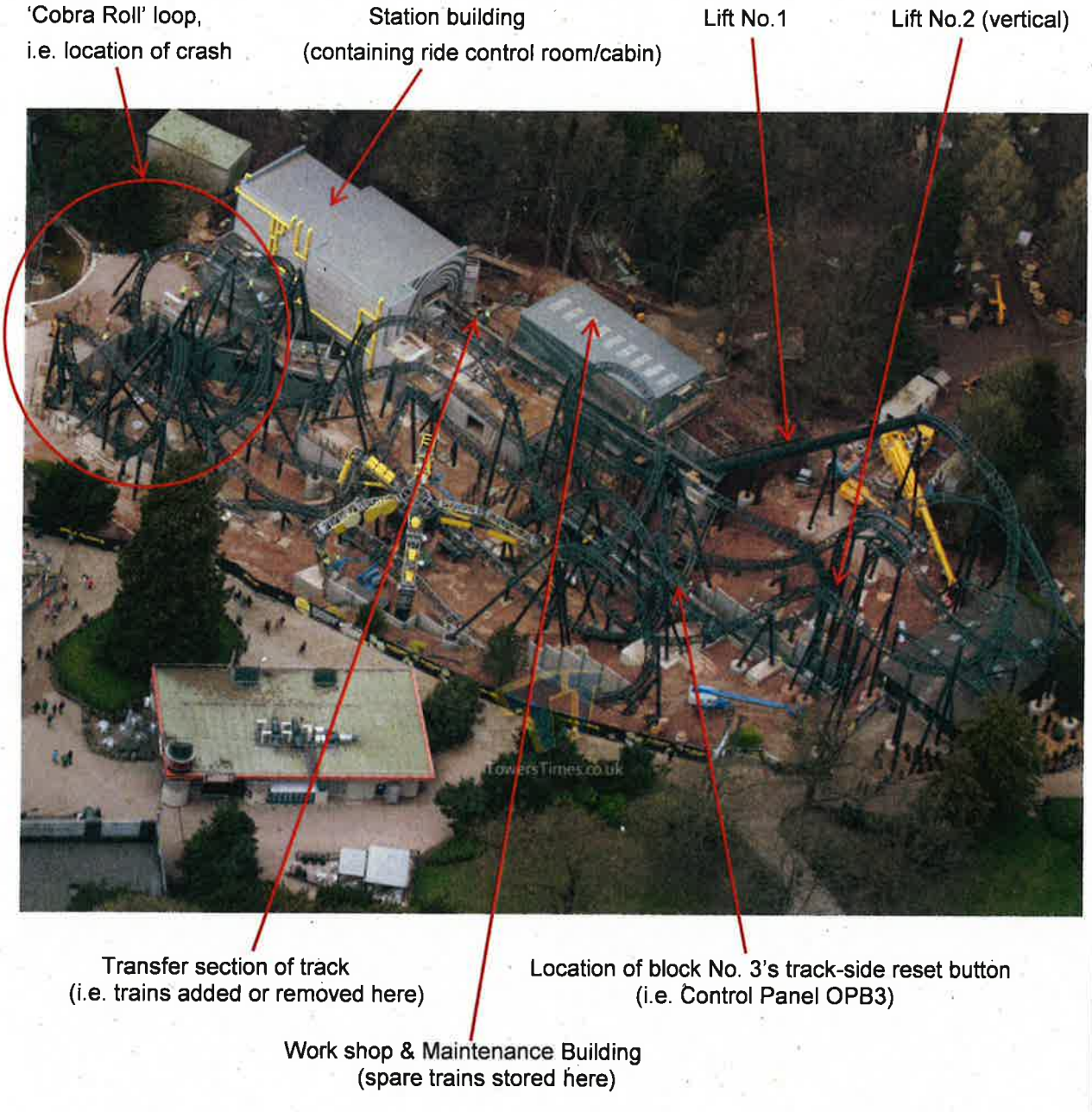
Describe the risk control measures in place at the time of the incident, including:

- **Physical protection**
- **Systems and methods of work**
- **Training and instruction**
- **Knowledge of the hazards and precautions by the relevant parties**
- **Supervision and monitoring**
- **Risk assessments**
- **Actual work practices (where applicable) up to the time of the incident**
- **Any measure that were missing or not in use**

Describe the factual underlying causes – identified by asking 'why' to the immediate causes in the context of the above management factors such as knowledge and monitoring. Professional judgement is needed to determine the appropriate extent of probing.

Introduction

1. The Smiler ride (roller coaster) was opened in May 2013 at Merlin Attractions Operations Ltd (T/A Alton Towers Resort) at their site in Staffordshire. The ride manufacture is Gerstlauer Amusement Rides GmbH. Smiler is a multi-loop steel roller coaster with 14 inversions (loops). The ride can have up to 5 vehicles (trains) running during operation. Each train has 4 rows of 4 seats, i.e. 16 passengers per train. There is a short free fall section of track from the station platform to the bottom of Lift No.1. There are two further vertical lifts on the ride, resulting in two long, free-fall sections of track. The Ride manufacturer, Gerstlauer, have stated that they supplied the Smiler ride to the current Standards, i.e. EN13814.
2. Figure 1. Illustrative photo, below, shows an overhead plan view of the whole Smiler ride:



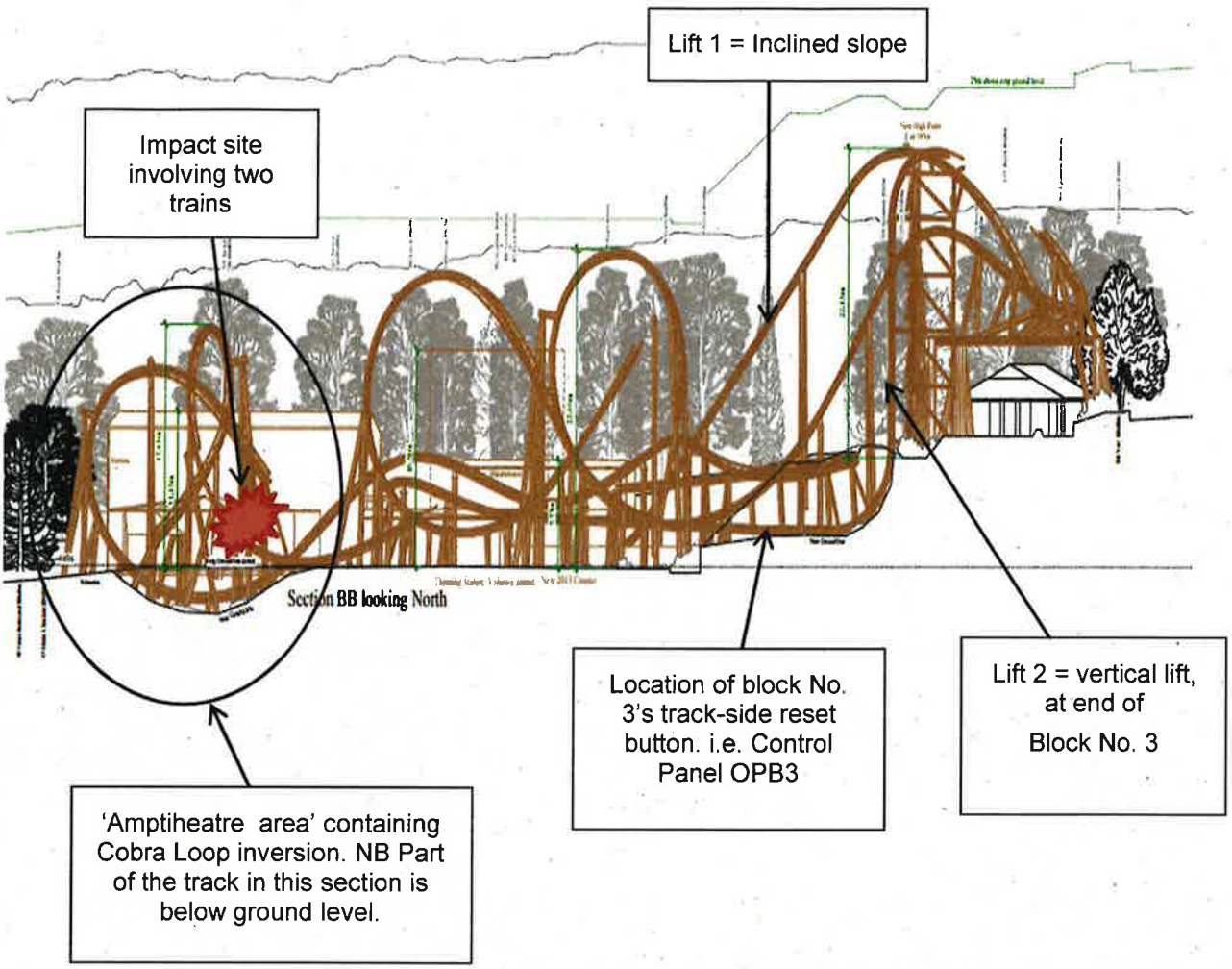
[http://forum.towerstimes.co.uk/viewtopic.php?f=104&t=35847]

3. Figure 2. Photo, below, taken by HSL during 1st day of train removal on 5/6/15 (post-accident).

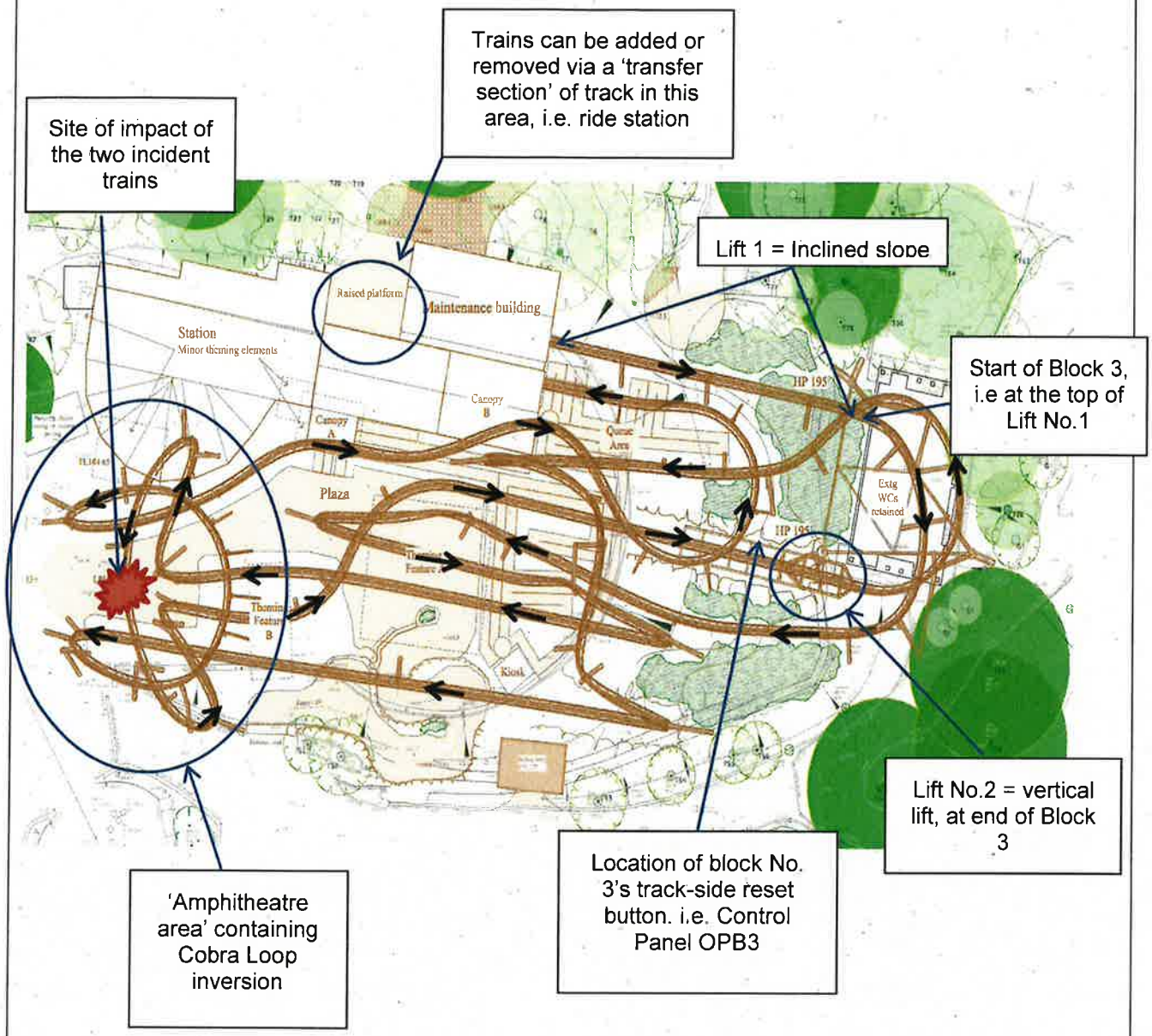
Stranded incident trains - part of the track goes below ground level at this location

[HSL Image ref: 1506011_074 – exhibit ref LM/69]

4. Figure 3 – Side profile view of Smiler ride

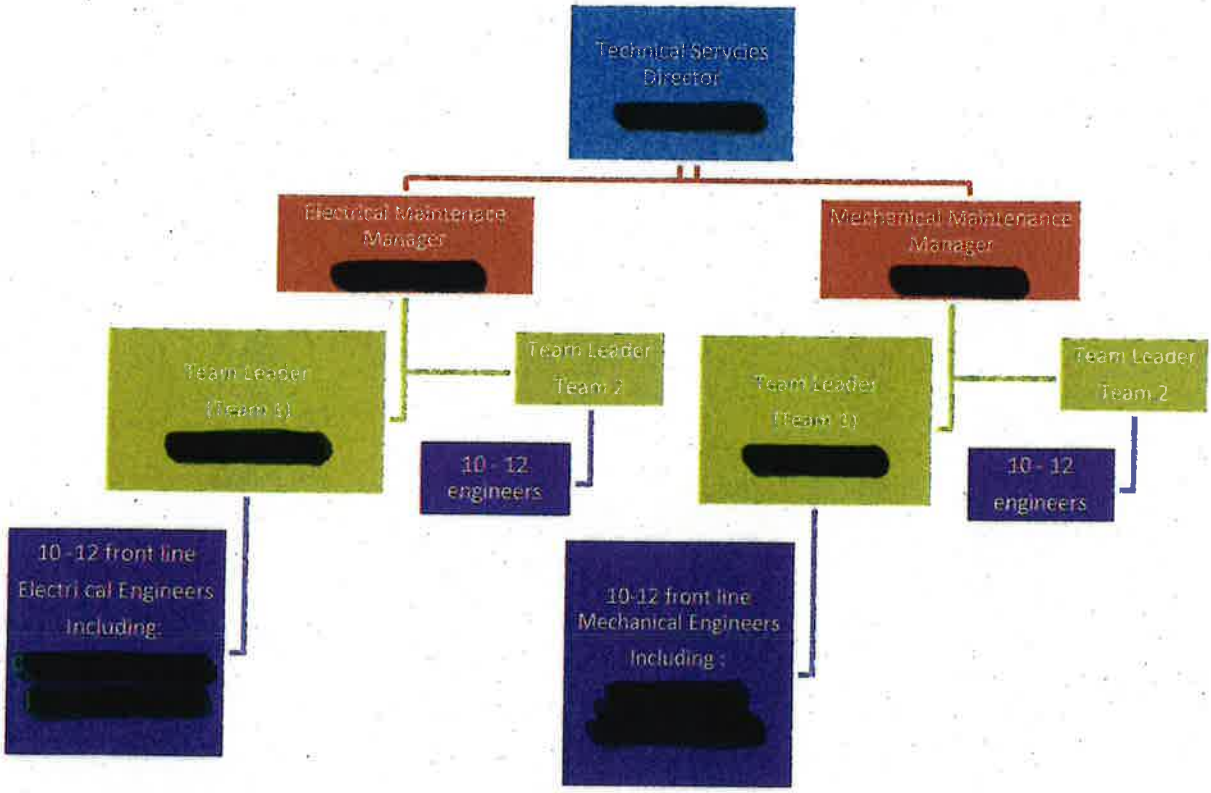


5. Figure 4: Plan view of Smiler ride



6. There are two teams of electrical & mechanical engineers at the Alton Towers resort. 'Team 1' consists of around 10 to 12 front line engineers. Team 1 covers one half of the Alton Towers Resort (i.e. the half which contains the Smiler ride). All ride engineers belong to the Technical Services Department. Team 1 only covers their half of the park – they do not cross over. See Figure 5, below, for a basic organizational chart showing the structure of the Technical Services Department. Four front line engineers attended the Smiler ride on the day of the incident, [redacted] and [redacted]. Prior to the incident, two mechanical engineers had added a fifth train to the ride, these were [redacted] and [redacted]. Shortly after this, they were joined by two electrical engineers, [redacted] to assist in dealing with a breakdown situation. Through the process of dealing with the breakdown and trying to get the ride back into operational use, two of the trains incorrectly entered the same block of track and a collision occurred. One of the trains was empty (the one in front), the other contained passengers. Some of the passengers (members of the public) who were occupying the train which impacted the stationary train suffered severe, life-changing injuries. The immediate and underlying causes for the incident will be discussed further, in the following report.

Figure 5 - Organizational Chart for Alton Towers Technical Services Department



7. Timeline line of events leading up to incident on 2nd June, starting from 13:06. (ref also exhibit LM/49 for a visual representation of events)

[NB The Smiler rollercoaster was in operation on 2nd June 2015, [redacted] was the ride operator on that day. Four trains are in operation from the start of the day. A fifth train is being stored in the ride's work shop (garage), located next to the station and adjacent to the 'transfer section' of the track.]

[Please note that the timings, below, are not *precise* to British Summer Time, as the information has been gathered from the Smiler's CCTV footage which a few seconds 'out', (HSL report RBL5 page 11). The timeline below should be regarded as indicative only].

- 13:06 – last "successful" train, with guests on board, leaves the Smiler station
- 13:06 – the injured persons (IPs) are loaded onto the next train on the platform

- 13:08 – a fault is generated on the ride, i.e. the start enable button (in the station load/unload area) had been pressed for too long. [redacted] becomes aware of a slow flashing light on the ride's control panel, indicating a fault condition. [redacted] and [redacted] (Mechanical Maintenance engineers) are called to attend the Smiler ride to rectify the fault (FLANAGAN, SR1, page 5). The fault is logged in the 'Daily Ride Report Sheet' [redacted] and also the 'Park Operations Breakdown Check List' [redacted]
- 13:10 – the IPs are removed from the train (sat on the platform) and are put back into the queue.
- 13:10 – a spare train is moved up, close to the work shop's door, in preparation of being added to the ride.
- The 'Daily Ride Report Sheet' [redacted] states that the ride is "downloaded to add 5th train", There are no further entries in the Daily Ride Report Sheet.
- 13:13 – the train the IPs were on leaves the station empty.
- 13:14 – another empty train arrives at the platform and leaves again, empty.
- 13:15 – a train arrives at the platform with guests on board, they get off. This train leaves again empty.
- 13:16 – another train arrives with guests, they get off.
- 13:19 – all four trains are now back within the confines of the station building, all empty of guests.
- The ride is put into MAINTENANCE mode by the two engineers, [redacted] and [redacted] They clear the minor fault by 'acknowledging' the message.
- 13:20 - [redacted] and [redacted] decide to add the fifth train as the ride is now empty of guests. Adding the fifth train takes around 5 minutes. [redacted] also informs 'Control' that a fifth train is going to be added. The 'Daily Ride Report sheet' [redacted] has been updated by [redacted] and his initials are present "download to add 5th train. Train 2".
- 13:25 – five trains are now on the ride, all empty, within the station block.
- There are seven fault codes recorded between 13:19 to 13:25. All these faults can be accounted for as a result of the process of adding the fifth train to the track. They indicate problems with trying to the appropriate control panel or proximity switches that indicate that the transfer track locking pins are not in place [redacted]
- 13:29 – an empty train is sent around the ride – this stops just short of Lift No.2 (i.e. fails to engage properly with Lift No.2). This causes the block it is in, Block No3, to show as being 'occupied'.
- 13:33 – four engineers assemble on the Smiler platform, i.e. [redacted] and [redacted]
- 13:33 – three of the engineers [redacted] & [redacted] are then observed making their way to the stuck train at the bottom of Lift No.2 (which is at the end of Block No.3). The other engineer [redacted] goes to the Smiler control cabin.
- 13:35 - [redacted] & [redacted] arrive at the bottom of Lift No.2. They use the Ai phone to communicate with [redacted] who is back in the control cabin. [redacted] & [redacted] manually push the train until it engages with Lift No.2.
- 13:38 – this train is observed being hoisted up Lift No.2.
- 13:38 - [redacted] & [redacted] then make their way back to Smiler control cabin.
- 13:40 – the train which [redacted] & [redacted] have just pushed onto Lift No.2 arrives back at the station.
- 13:40:01 – all five trains are now back at the station, all empty of guests.
- 13:40:14 – the empty train at the front of the queue (underneath the station building) is sent around the ride (empty). This is Alton Towers train number 3. It climbs the first lift (Lift No.1) and goes straight into the first gravity section of track, i.e. Block No.3.
- 13:41 – this train stalls at the apex of the 'Cobra Loop' (aka 'Staffordshire Knot Loop). It hangs upside down at the top of the apex for approx. 20 seconds before it slips backwards, pendulums at the bottom of the loop and comes to rest.

- 13:41 – IPs are reloaded onto a train on the platform (Alton Towers Train 4) and this train sets off around the ride.
- 13:43 – IPs train arrives and stops at the crest (top) of Lift No.1.
- 13:44 – A 'block stop fault' is logged onto the 'Park Operations Breakdown Checklist' [redacted] The location of the trains are also noted as "4 vehicles ground level 1 vehicle top of lift 1". [redacted]
- 13:44 – the valleyed train comes to its final resting position in the bottom of the Cobra Loop, in a section of the track known as the 'Amphitheatre' (see Figures 1, 2, 3 and 4, above).
- 13:44 to 13:49 – [redacted] leaves the Smiler control cabin, makes his way to the bottom of Lift No.2. He performs a trackside block reset at the remote control panel, OPB3. [redacted] then makes his way back to the control cabin at the station building. [redacted] arrives back at the cabin at 13:49.
- [redacted] asks central 'Control' for another 'Code Zero' to bring all the trains back to the station, one by one under the command of the ride's control system. In EVAC mode the trains are returned to the station, starting with the train most advanced through the track and working backwards. Permission is granted over the phone.
- [redacted] checks with the Electrical Maintenance Engineers [redacted] whether it is ok into 'EVAC mode' – they answered to the affirmative and told her it was ok to proceed.
- A Code Zero would entail putting the Smiler's ride mode from 'MAINTENANCE' mode to 'EVAC' (evacuation) mode. The reason for needing a code zero is to perform a 'reset' on the ride prior to putting back into 'NORMAL' mode for operational use. The ride cannot be put from 'MAINTENANCE' mode straight to 'NORMAL' mode
- 13:50 – a 'Code Zero' is initiated on the Smiler. In accordance with the programmed logic of the Smiler's EVAC mode, the control system began moving the train which it believed was furthest through the ride experience, i.e. the train loaded with the IPs at the top of Lift No.1, having being told to 'ignore' the occupied status of Block No.3 (i.e. the valleyed train) by the engineers.
- 13:51:05 – the IPs train is released from the top of Lift No.1
- 13:51:31 – IPs train crashes into the back of the valleyed train at the bottom of the Cobra Loop.
- 13:52 – two engineers leave the Smiler's control cabin to 'take a look' at what has happened.
- 13:56 – further staff arrive at Smiler's control cabin
- 13:58 onwards – tower scaffold began to be erected under the Cobra Loop.

<u>Physical protection & Ride's integrated control systems</u>

8. The Smiler has undergone the normal route for commissioning & installation "systems for safety of attractions", in accordance with HSG175, i.e.;
9. The Smiler ride has been designed by Gerstlauer Amusement Rides GmbH.
10. The in-service annual inspection (Declaration of Operational Compliance (DOC)) was completed by LTC Ltd [redacted] The DOC references that the following documents (are in place);
    - Design review has been completed by Design & Safety Consultants (UK) Ltd
    - Manufacture & assessment of conformity to design has been completed by ADIPS inspection body (i.e. by Design & Safety Consultants (UK) Ltd).
    - Initial tests have been completed (i.e. by Design & Safety Consultants (UK) Ltd).
11. In accordance with the relevant Standards for roller coaster rides (EN 13814:2004), this type of ride employs a 'block zone system' whereby several trains can be in operation on the system at the same time, with an automatic fail-safe control system (the ride's PLC) which ensures the carriages are separated to prevent collisions between them. The entire track is split into 'blocks' (sections) which have braking facilities & sensors at the entry / exit points to each block which is under the complete control of the ride's PLC which ensures that only one carriage can occupy a block at any one time.
12. Some blocks can be relatively small, e.g. a single train length within the station building, others can be very long, e.g. one of the main free-fall sections of track. The ride also has 'trim brakes' at strategic

points on the track which can reduce the speed of a vehicle should it be detected as traveling too fast.

13. The ride PLC dictates (to the Ride Operator) when trains can be dispatched from the station building in order the send them around the track. In normal operating conditions (in NORMAL mode), once the ride vehicle has been dispatched from the station building, it will automatically advance from block to block, under the PLC's control / monitoring system, until it has completed the 'ride experience' and arrives back at the station platform.
14. Should a vehicle attempt to enter a block which the PLC has registered as being already occupied the control systems will automatically initiate a 'block stop' which halts the train(s) (behind the occupied block), in a safe position. The vehicles subject to a block stop will remain stationary until the ride's PLC registers that it is safe to advance the trains again, i.e. the 'receiving' blocks are showing as empty.
15. The Smiler ride has a 'control panel' (also known as the 'human machine interface', HMI) which includes a visual display of the track layout, blocks, ride status, etc.

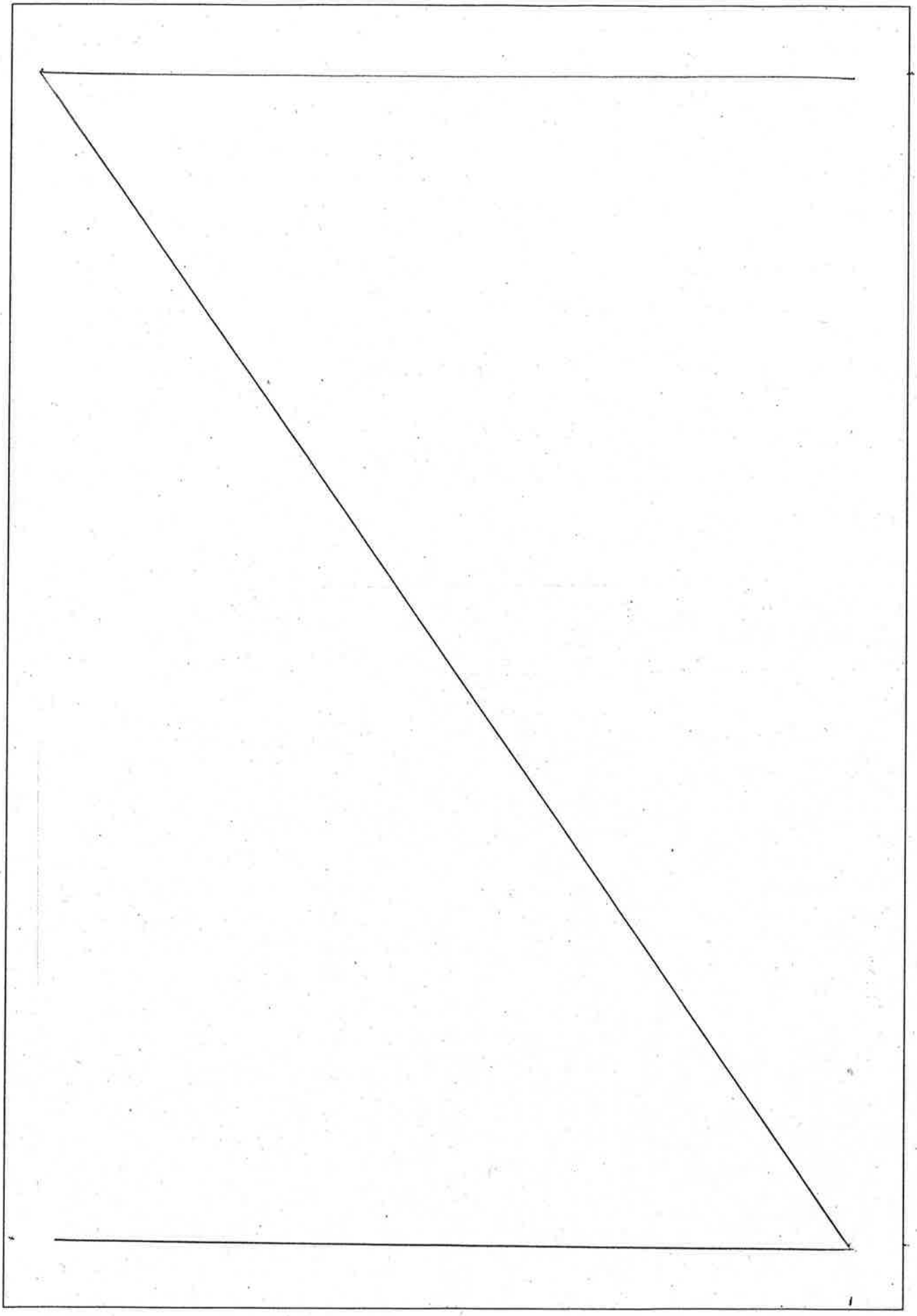
    There is a key switch in the control panel which can be moved to four positions (or four 'modes'). Mode No.1 is 'TEST MODE', mode No.2 is 'MAINTENANCE', mode No.3 is 'NORMAL' and mode No.4 is 'EVACUATION' (aka 'Code zero' or 'EVAC' mode). Ride Operators only use key Mode 3 and 4 [redacted]

    Engineers need to use an identification and password in order to log into the HMI to carry out safety critical interventions on the ride, i.e. in MAINTENANCE or TEST mode [redacted] Ride Operators do not have access to these identifications and passwords [redacted]

    Fault codes and fault messages are displayed on the Smiler's HMI screen. They are as follows [redacted]

- Blue messages are for information only
- Yellow messages are WARNING faults which prevent further running of the ride, e.g. lack of compressed air.
- Red messages are 'ZONE STOP' (also referred to as 'BLOCK stops' in some witness statements) faults which prevent any further train dispatches until the necessary remedial action taken to safely restart the ride. Red messages can be generated due to; proximity switches that have operated aberrantly, faults with limit-switches on passenger restraints, blocks remaining occupied by a train (because it has failed to complete that block).
- Deep red message are EMERGENCY STOP, i.e. one of the emergency stop buttons has been activated or if the ride's on/off switch was operated.

See also Figures 6 & 7, below.



16. In respect of the Smiler ride's programme functionality, the feedback from HSL (Electrical & Instrumentation) specialists, [redacted] indicates that the ride programme / PLC / sensors appeared to be functioning satisfactorily and in line with expected standards, i.e. it did what it was supposed to do, prior to the manual intervention by the ride engineers (i.e. to manually clear a 'block stop' fault) [redacted]. In summary [redacted] states *"In conjunction with reviewing the CCTV footage from the day of the accident, and the build up to train four being stopped by the control system close to the top of lift L01, because block B03 (the next block on the track) was occupied by train three, in my opinion suggests that there is no evidence that the roller-coaster's control system had malfunctioned"*

17. [redacted], also confirms that the actions & sequence of event to carry out a block reset, as per the day of the incident, is as described in the relevant employee witness statements. Engineers need to be logged-in (using a password) in order to perform a block reset. The Ride Operator [redacted] would not have the ability to re-start the roller coaster after a 'block stop' fault without first getting an appropriate intervention from the engineers [redacted]

18. It is worth noting that [redacted] also states, in his report, that *"most of the fault codes recorded in the log do not describe clearly the reason the fault has been generated"* [redacted]

19. [redacted] also confirms that the Smiler PLC was not set up to generate an error if a train took too long to travel through a block. [NB - this has since been remedied by [redacted], with the assistance of the ride manufacturer, [redacted]

20. [redacted]

21. There are 25 CCTV cameras present on the Smiler ride. The CCTV cameras are split into two systems. CCTV system one, cameras 01-09, is five seconds slow. CCTV system two, cameras 01 to 16 is three seconds fast (HSL report RBL5, page 11). The cameras are positioned at various locations around the Smiler to give views of the track. The CCTV images are displayed on two (50") screens mounted above the ride control panel and also on two LCD 15" screens positioned on top of a wall mounted cabinet. All these CCTV screens are located inside the Smiler control cabin, inside the station building. Therefore, the ride operator and ride engineers would have access to the information on the HMI screen and also the images in the CCTV screens to identify the location of trains on the track [redacted] page 25).

22. The CCTV images on the smaller 15" screens are *'very small and little detail could be seen whilst standing at the main control panel'* [redacted]

23. Ride engineers have stated that the images on the CCTV screens (i.e. views from the cameras) do not cover the whole of the track, the order of the images can be moved around on the screens, or camera angles can sometimes slip [redacted]

24. The key CCTV camera is CAM09, the "Pit Camera". [redacted] comments, in his report, that only the last two rows of the stationary stranded train were visible on the CCTV image, on camera CAM09, as other parts of the track were largely blocking the view [redacted] See Figure 8, below.

Figure 8 – photograph taken from [redacted] – this shows the view from the CCTV "pit camera". The rear of the stationary, valleyed train (Train 3), from the day of the incident is partially in view. This is prior to the crash.

25. The two 50" screens, i.e. the larger CCTV screens, were no longer active shortly after the accident as the CCTV recording devices had been taken into possession by the Police.

Systems and methods of work

26. In order to maintain on-going ride integrity MAOL engineering staff carry out planned, daily /weekly / monthly checks on the Smiler. These checks are carried out when the ride is not open to the public. There is no evidence to suggest that this is not being suitably and sufficiently carried out. Witness statements indicate that engineers, such as [redacted] are trained and signed off for this type of work [redacted] – see also [redacted]
27. Each morning the technical services staff hand-over the ride to the ride Operator for operational use, after they have completed their daily pre-use checks etc. They put the Smiler operating mode into 'NORMAL' mode, ready for the ride Operator to open the ride to the public.
28. Post-incident, no evidence was found that the track itself was defective. The Smiler underwent an independent examination by Jacobs Engineering which found gaps in the track which were larger than would normally be expected but (in the opinion of Jacob's engineers) would not contribute significantly to reducing the speed of a train [redacted]
29. During post-incident examinations, nothing been identified to indicate that the trains themselves were defective or improper. The [redacted] confirms this [redacted] The train's wheel bogies and 'ball joints', connecting the train sections, were dismantled and examined, at [redacted]. The aim of the examination of these parts of the trains was to identify any potential issues which may have contributed to the front empty 'incident train' becoming stalled on the 'Cobra Roll' part of the Smiler track (i.e. in the amphitheatre area). [redacted] has stated that "*In my opinion, none of the bearings exhibited abnormal or excessive rolling resistance*" [redacted]
30. In order to carry out a block reset (i.e. to manually override the ride's PLC system and clear the PLC's belief that a block is occupied by a train) the mode must be set to 'MAINTENANCE' and password logged-in (i.e. by an engineer), [redacted]

Training and Instruction

31. Ride Operators (NB not ride engineers) appear to have a structured training and assessment package for their work activities, including stipulated minimum hours spend learning / training on a particular ride – they have detailed documents covering their work. i.e. 'Ride Training Procedures - Code of Safe Working Practice' (COSWP 70) and 'The Smiler Code of Safe Working Practice' (COSWP 34) (both documents contained within [redacted]. Ride Operators on the Smiler usually only operate the ride in 'NORMAL Mode', which is where the ride's PLC dictates how the trains proceed around the track.
32. Ride Operators also, exclusively, use a ride mode called 'Evacuation Mode' (aka 'Evac mode') which is unique to the Smiler. Evac mode (aka 'code zero') it is another automatic mode (i.e. under the ride's PLC control) which enables the Operator to bring the trains back to the station, one by one. This performs a 'reset' on the Smiler after which it can then go back into NORMAL operational mode.
33. Of the two electrical engineers who attended on the day of the incident, relevant qualifications held are as follows [redacted]

[redacted]

34. [redacted]
35. MAOL utilize a 'shadowing a more experienced engineer' system in order to train up their new engineering staff. Whilst engineer's ability to carry out pre-scheduled daily/ monthly proactive checks (planned preventative maintenance) is checked & audited by a Team Leader, (after the engineer has spent a period of time shadowing other experienced engineers), there is no evidence to suggest that when engineering staff attend 'breakdown work' on rides, that these tasks have been formally trained out, audited, overseen or supervised by the management team [redacted]. Due to using this 'shadowing system', it remains unclear how Alton Towers can account for the content or quality of training and information being given to the engineering staff (by their fellow engineers) who are either a new engineer to a ride or the ride itself is new, i.e. for work involving breakdown / block resets situations.
36. The two Electrical Maintenance engineers who performed the block reset on the Smiler on the day of the incident, i.e. [redacted] and [redacted] had not seen / been appraised / given any formal training or written procedures for how to go about performing a block reset [redacted]
37. The two Electrical Maintenance engineers in question had not seen any risk assessments for the Smiler ride [redacted]
38. The four engineers who attended the Smiler on the day of the incident had not seen and/or not read Gerstlauer's 'Original Operating Instructions' [redacted]
39. [redacted]

40. [redacted] (Engineer who performed the track-side reset [redacted] did not appear on the training matrix which was in place at the time of the incident [redacted] – 'Technical Services Training Register – Updated 20.9.2014) [redacted]

41. At the time of the incident, no records existed detailing the amount of time a ride engineer has spent 'shadowing' another (e.g. more experienced engineer) on *breakdown* work. MAOL have not provided evidence to demonstrate the type, amount and quality of 'breakdown work' the trainee has observed and/or been shown for the period running up to the incident, i.e. for higher risk tasks, such as manual block resets

In their written submissions [redacted] MAOL state, (twice);

[redacted]

[redacted]

Knowledge of the hazards and precautions by the relevant parties

42. Ride engineers' training for 'ride breakdowns' is also based on a one-to-one / shadowing system. The content of this one-to-one buddying system has not been laid down by MAOL. MAOL has not demonstrated or shown to the HSE, using prescribed a written structures or documentation, what each individual engineer understands, has seen or been told about how to safely go about performing a manual block reset [redacted]

43. [redacted]

44. Engineers were unclear that the Smiler does not have a 'time out' function. A 'time out' fault message is when the ride's control system detects that a carriage has taken too long to traverse a section of track (block of track) and gives a warning message on the HMI screen to that effect. There was not a specific warning message for the Smiler. This differs from some other rides on the park, e.g. the ride called "13". [redacted]

45. The previous instance of an operational valleyed train, in the same spot as the incident train, was not formally disseminated to relevant staff. No 'alert' or 'warning' of potential problematic sections of track had been issued. [redacted] / [redacted] / [redacted] / [redacted] / [redacted].

46. 'Gusting wind' conditions is only a consideration / limiting factor for the Skyride, not the Smiler ride. According to MAOL's procedures, the Smiler has to reach a constant 34 mph to be shut down [redacted] – section COSWP 38, revision 8, "Code of Safe Working Practice, Operating Rides in Adverse Weather Conditions & ENGLISH, page 5). However Gerstlauer's operating instructions states *"the ride must be shut down if "Wind force 7" is reached (~34 mph, (~15m/s), stormy wind, trees are oscillating)* [redacted]

Supervision and monitoring

47. At the time of the incident there were no formal provisions for monitoring, supervision, e.g. for carrying out breakdown / block resets for the maintenance engineers. It appears to be rare that a Technical

Services Manager would attend a ride in a breakdown situation, e.g. to oversee a block reset process [redacted]

48. Ride Operators appear to have adequate systems of work. The supervision of ride Operators is subject to one qualification, i.e. the procedures which permit ride Operators to seek a 'code zero' (in order to safely recover trains back to the station under the control of the ride's PLC, providing that the control system has an accurate understanding of the location of all of the trains i.e. without any manual block resets). The granting of permission to undertake a 'code zero' is given by the parks central 'Control' hub and this is done over the phone. This appears to be mere formality with no first-hand attendance required by staff from 'Control'.

Risk assessments

49. R/As were in existence [redacted]

Engineering staff involved with the incident, [redacted] & [redacted] had not had sight of these documents [redacted]

Work Practices up to time of incident

50. Engineers had not been instructed and trained to appoint a 'lead engineer', e.g. for a ride breakdown situation, where multiple technical services staff are attending.
51. At the time of the incident there was no safe system of work in place requiring staff to scrutinise ride logs & documents, i.e. to ascertain the status of the ride before starting to intervene or work on the Smiler. It was custom and practice to fill in the required ride paperwork retrospectively [redacted]
52. Engineers [redacted] and [redacted] had not been formally signed off to work on the Smiler ride. [redacted]
53. Ride engineers appear to be unclear and inconsistent about the rules surrounding 'being allowed' to move trains whilst guests are still present on the Smiler ride [redacted]
54. [redacted]
55. There existed a lack of clarity, amongst ride staff, surrounding the requirement, circumstances and number of test vehicles which should be sent around the ride after a ride intervention has taken place (when the ride is in operation). There were no formal procedures in place to manage this issue. At the time of the incident it appears to be left up to the engineer's discretion. [redacted]

Any measures that were missing or not in use (summarising from sections above)

56. It was not custom and practice to formally establish number of trains present before carrying out breakdown intervention on the Smiler, i.e. no requirement to scrutinise the ride documents & daily logs first, [redacted]
57. There were no provisions or requirements to establish a lead engineer in at a ride breakdown intervention.
58. There were no procedures covering formal hand-over arrangements between the ride engineers.
59. No formal arrangements and safe systems of work were in place to instruct, inform and train staff in how to go about safely performing a manual block reset.

There were no procedures or systems of work requiring senior management 'authorisation', or first-hand presence or oversight to confirm & validate a decision to perform a block reset, prior to it going ahead.