



# BCA Ride Manager's Forum 2024

## Best Practices in Ride Maintenance & Inspections

23<sup>rd</sup> January 2024

**Zishan Amir**

Managing Director (ZRG Adventures & Consulting)

Secretary General & Chairman of Safety Council, Association of Singapore Attractions


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ASTM F24 Technical Committee Member

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# Recent Incidents - 2023




 **American Amusement Park Museum** 1 Jul 2023 · 🌐

After the discovery of the cracked support on Fury 325 at Carowinds this is what guests will see coming to the park today ...a shrink wrapped support column.

(The ride is closed until further notice, this is real and was taken this morning and is just a way to cover the crack until fixed)




 **CHINADAILY** 中国日报网 中文

Home / China / Society

### Eight injured in Roller coaster collision at Happy Valley Shenzhen theme park

By WANG XU | chinadaily.com.cn | Updated: 2023-10-28 19:53



People walk pass the Happy Valley Shenzhen with a closure notice, in Shenzhen, Guangdong province, on Oct 28, 2023. [Photo/VCG]

At least 8 people were injured as a roller coaster collision occurred at Happy Valley Shenzhen on

## Outdoor adventure firm Camelot charged over lapses that caused ACS(I) student's death during rope course

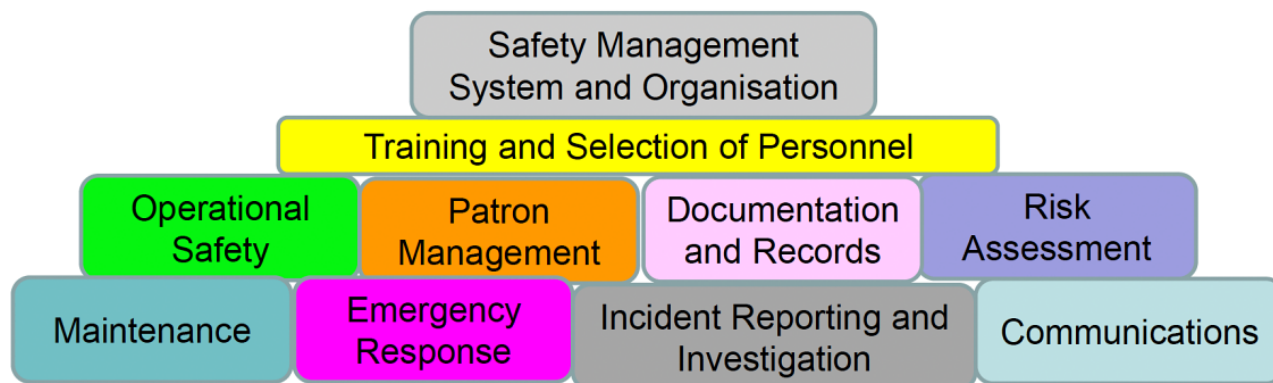
**Jethro Puah Xin Yang was suspended in a loose harness after falling off the rope course and died from multi-organ failure following traumatic asphyxia.**



The rope course was held at the SAFRA Adventure Sports Centre in Yishun on Feb 3, 2021. (Photo: CNA)

# Ride Safety Management

## System and Accountability



*Amusement Ride Safety Management System*



### Duties of a Ride Manager;

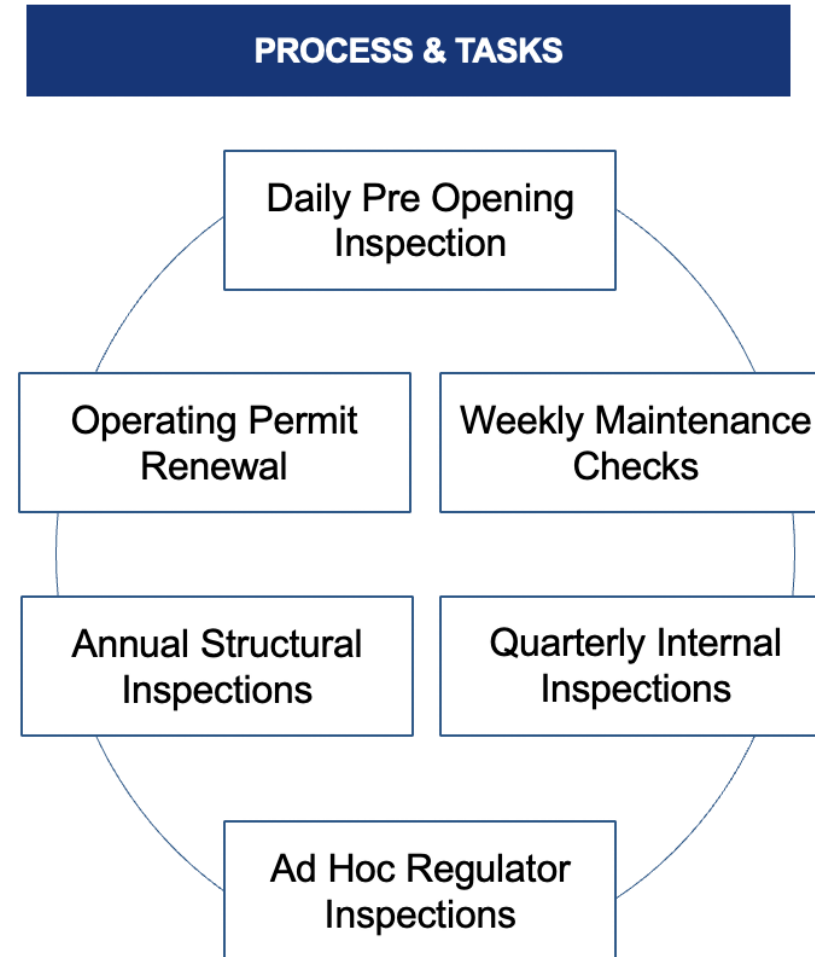
Oversee, manage and supervise the daily operations and maintenance of the amusement ride

- Conformance to SOPs, standards and permits
- Staff training & qualification
- Operational Safety & Requirements
- **Inspections & Checklists**
- **Ride Maintenance**
- Incident reporting
- Emergency Response
- Safety Bulletins

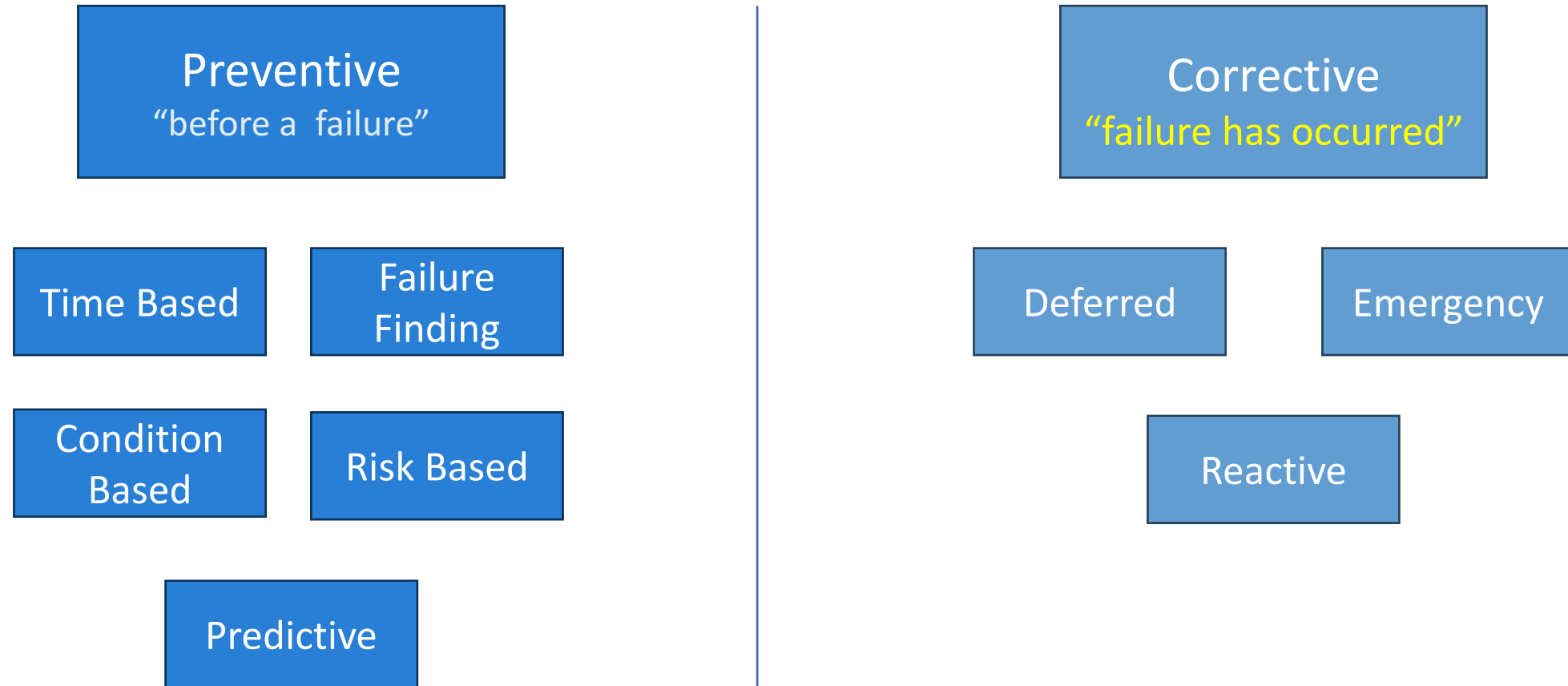
# Typical Maintenance / Inspection Framework



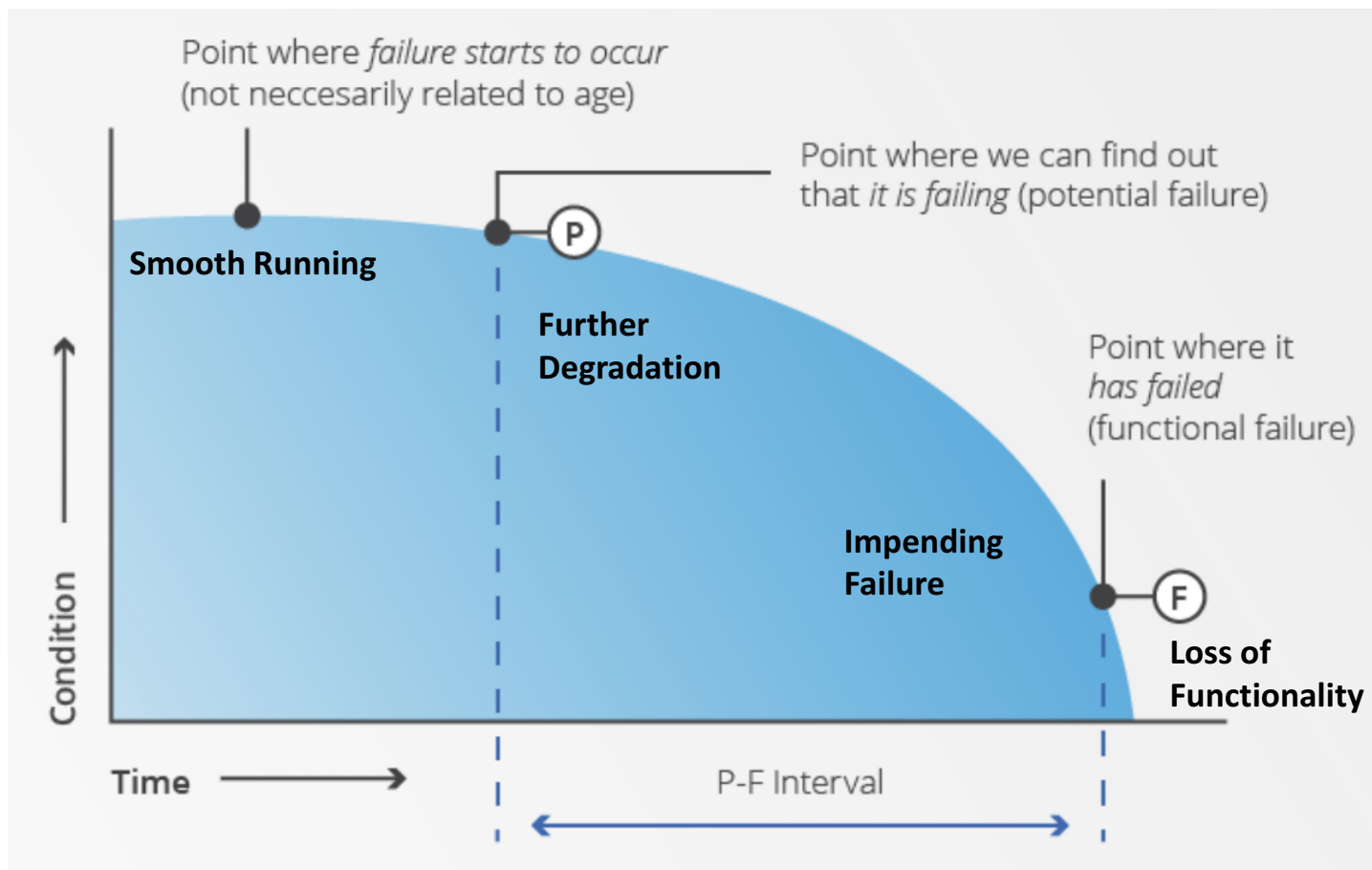
TEAM	DESCRIPTION / ROLE
General Manager	Responsible to the local regulator and landlord for the overall safety of the ride
Operations Director	The direct liaison with the regulator to coordinate inspections and ensure compliance with regulations
Maintenance Manager	Responsible for implementation of all regulator requirements and oversight of maintenance team
Snr Maintenance Technician	Skilled ropes access and maintenance technician able to execute all works directed by management.
Maintenance Crew	Support staff responsible for routine checks and servicing of structures, cables, equipment and obstacles



# Types of Maintenance



# Performance – Failure Curve (PF Curve)



**Common rule of thumb is for the intervals of your Condition Based Maintenance should be 1/2 or 1/3 of the P-F Interval to allow for timely intervention.**



# Types of Inspections

**Reference: ISO/IEC 17020**

**Type A Inspection** – Independent, third-party inspection, conducted by an external inspector. This level of inspection can be conducted by a Specialist Professional Engineer, Conformity Assessor or Ride Manufacturer.

**Type B Inspection** – Second party inspection, conducted by specialised and qualified in-house personnel of the organisation. This level of inspection can be conducted by the Ride Managers and Maintenance Manager.

**Type C Inspection** – First party inspection, conducted by the on-ground operations team as part of the periodic inspection (daily / monthly). This level of inspection can be conducted by the Operations Staff before the start of daily operations.

# Maintenance Best Practice

Technology



- Ongoing process of continuous improvement
- Deliberate planning and execution
- Keeps our rides safe and increases / improves the shelf life

# Maintenance Best Practice - Schedules



- I=Inspect and then clean, adjust, replace, or grease if necessary.
- N= Clean.
- C= Replace.
- R = Retighten.

## Schedule Considerations

- Manufacturer's Recommendations
- International Standards
- Local Requirements
- Operating Hours
- Estimated Time to Perform
- Manpower Availability
- Due Date / Equipment Condition
- Lighting & Access

Parts	Every or once per	0.5 h (end of run-in)	3h Day	20 Hrs Week	100 h Month	1000 h Year
Floor and fasteners			I		R	
Steering tie rods			I			
Front axle unit and fasteners		R			R	
Alignment		I			I	
Steering wheel and fasteners			I	R		
Steering column and fasteners			I	R		
Adjustable steering column setting (if equipped)			I			
Rear shaft pins			I			
Rear wheel hub			I	R		
Bearings and bearing supports			I	R		
Rear axle			I		R	
Tyre pressures			I			
Tyres wear			I			
Condition of rims			I			
Rim tightness				R		
Seat and fasteners			I		R	
Protections			I		R	
Pedals			I		R	
Operation of the adjustable pedal unit			I			
Brake fluid			I			C
Brake pads			I			C
Brake disc			I			C
Throttle cable			I			C
Brake hose			I			
Engine					N	
Reducer oil (*)					I	
Battery					I	
Belt			I			C
Safety stickers			I			

(\*) Replace every 350 hours.

# Maintenance Best Practice - Training



- In House Training / OJT
- External Specialised Courses (eg. NDT, Welding)
- External Professional Qualification / Courses (eg, Technical Requirements for Amusement Rides, NAARSO)

# Maintenance Best Practice - Documentation



## Key points to consider

- Paper vs Digital
- Document access and version control
- Review schedule (Annually?)
- Lock out / tag out procedures
- Usage of videos
- Developing common terminology to avoid confusion
- Compliance requirements
- Training qualification requirements
- Trainer qualifications

**SCAP8** Daily Inspection Form Tuesday, November 1, 2022

**SCAP8**

Date of Inspection: Tuesday, November 1, 2022

Inspected by: Sharul / Ashraf / Kye J

### Ground Inspection

Visually inspect the structure for any deformities and structural damages. (e.g dents, cracks, and leaning of structures.)

Check and clear any debris found on the ground floor.

Check the base plate of each pillar for any loose or damage bolts and nuts.

Visual inspection of torque stripe alignment on bolts and nuts for ground and level 1 bottom structure.

**Comments**  
- Ground floor torque stripe not done well

### Continuous Belaying System Inspection

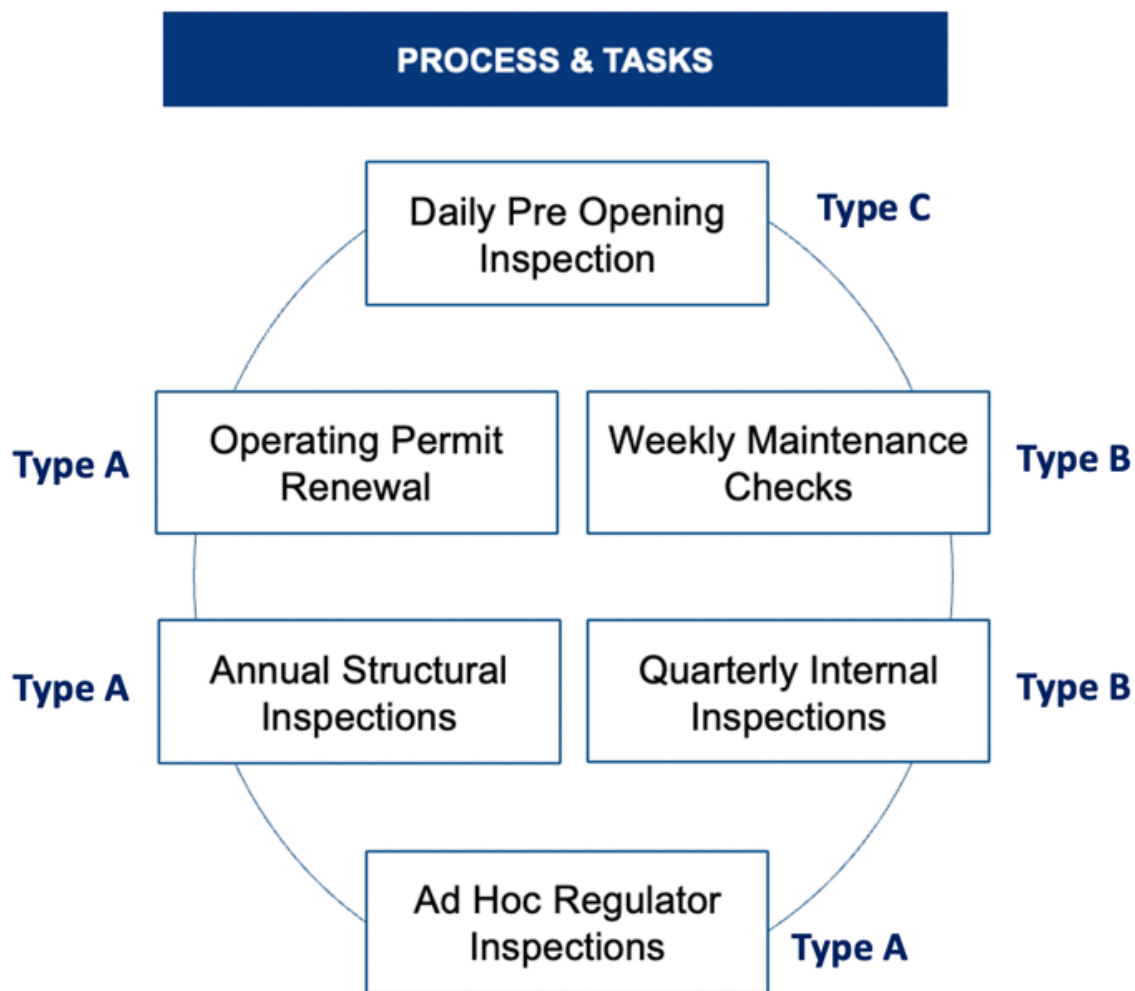
Inspect the small and large nylon Nylon Guard for any damages that can affect the usage of the trolley.

Inspect the velcro cover to ensure that there is no damage or wear and tear.

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## Sample Checklist

# Maintenance Best Practice - Audits



**Internal & External Audits are crucial to identify and address gaps in your own processes to promote continuous improvement**

# Best Practice Summary



- Establish and follow an effective maintenance schedule.
- Document maintenance thoroughly, using the appropriate forms and records.
- Train maintenance staff in general engineering skills and safety practices.
- Audit regularly to identify and address trends, gaps or issues.
- Use technology to help you improve your overall maintenance programs.



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