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AMUSEMENT RIDES AND  
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# Content

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Ride Certification Scheme

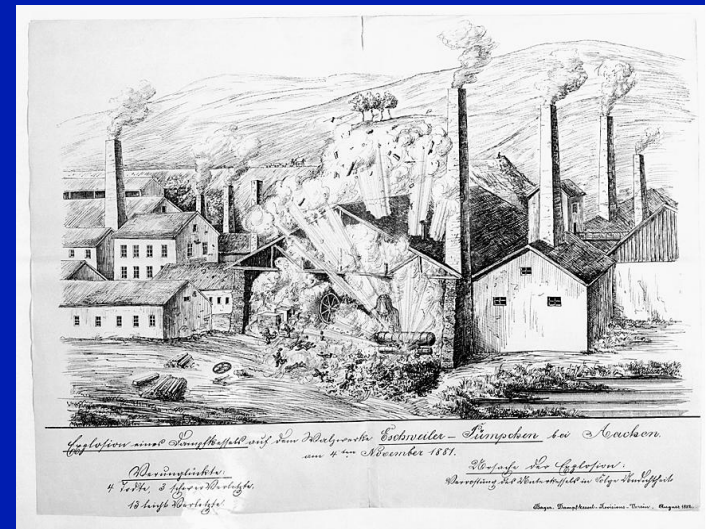
4

Risks- Incidents- Accidents

**1866** Foundation of TÜV SÜD as  
“Pressure Vessel Inspection Association”.

**1874** **Legitimation by the King** for the TÜV-  
Pressure Vessel Inspection Association  
with the goal to prevent people,  
environment and things from disadvantage  
of the technology.

**1929** Testing of Amusement  
Rides at the Oktoberfest.



# 1899 Russian Swing (Ferris Wheel)



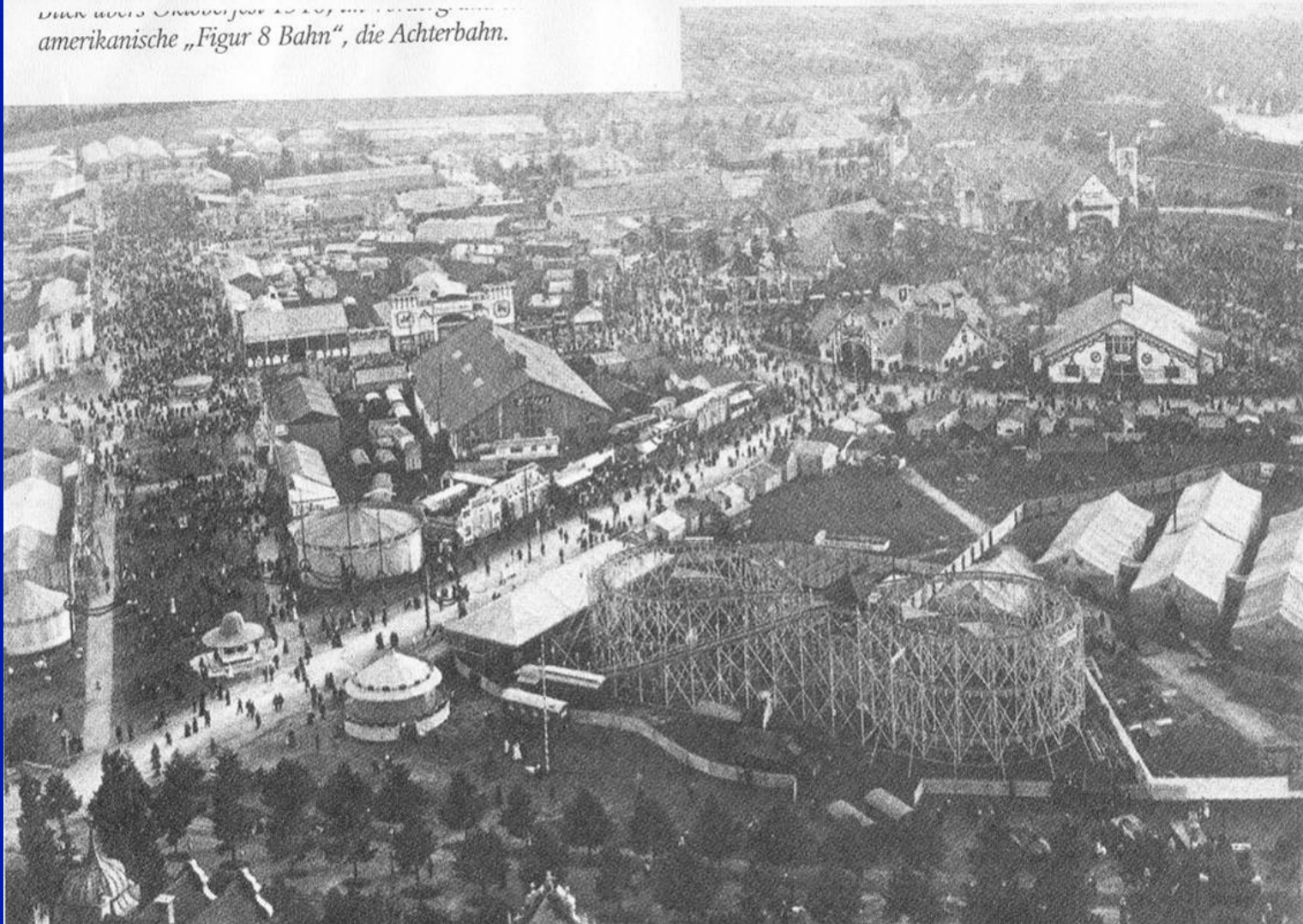
# 1906 Toboggan



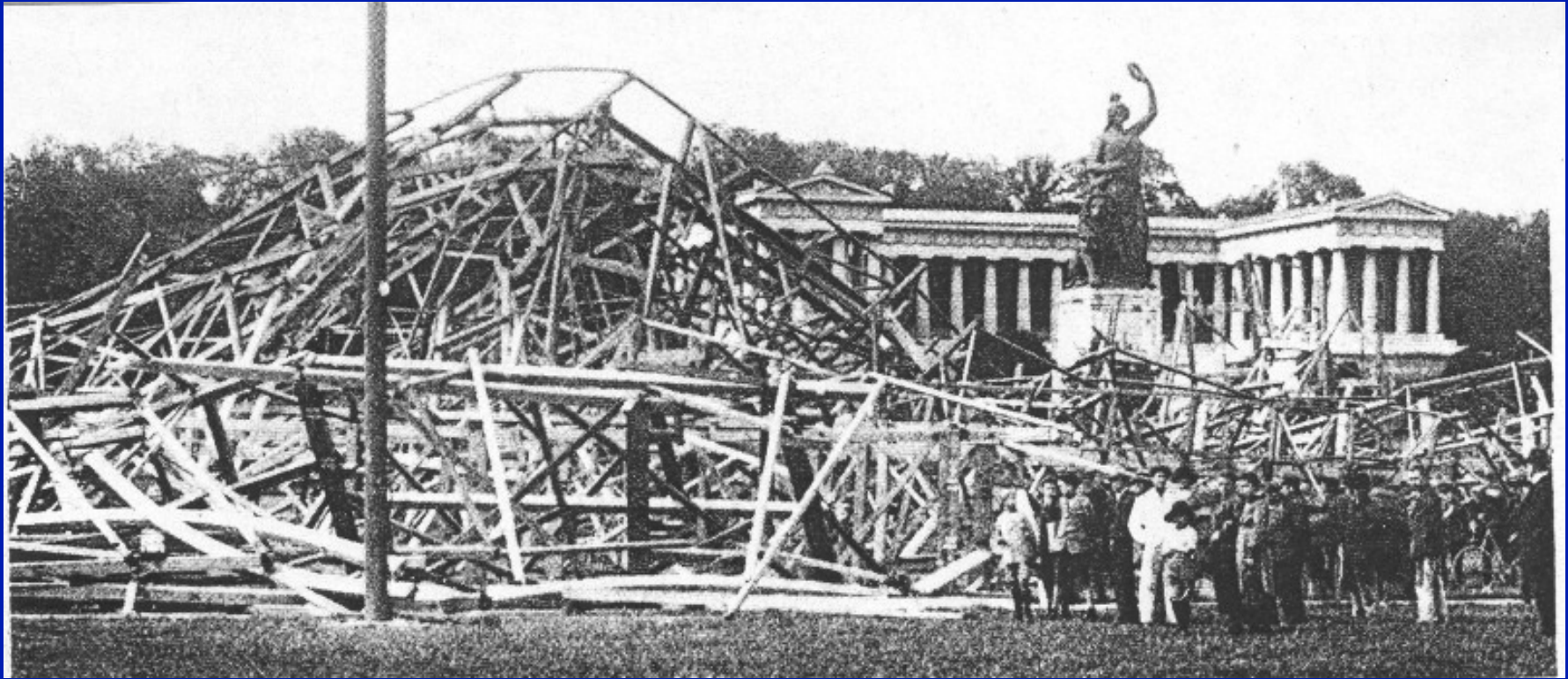


# 1910 First Roller Coaster

*Die erste Achterbahn der Welt, die amerikanische „Figur 8 Bahn“, die Achterbahn.*



# 1921 Collapse of the Roller Coaster

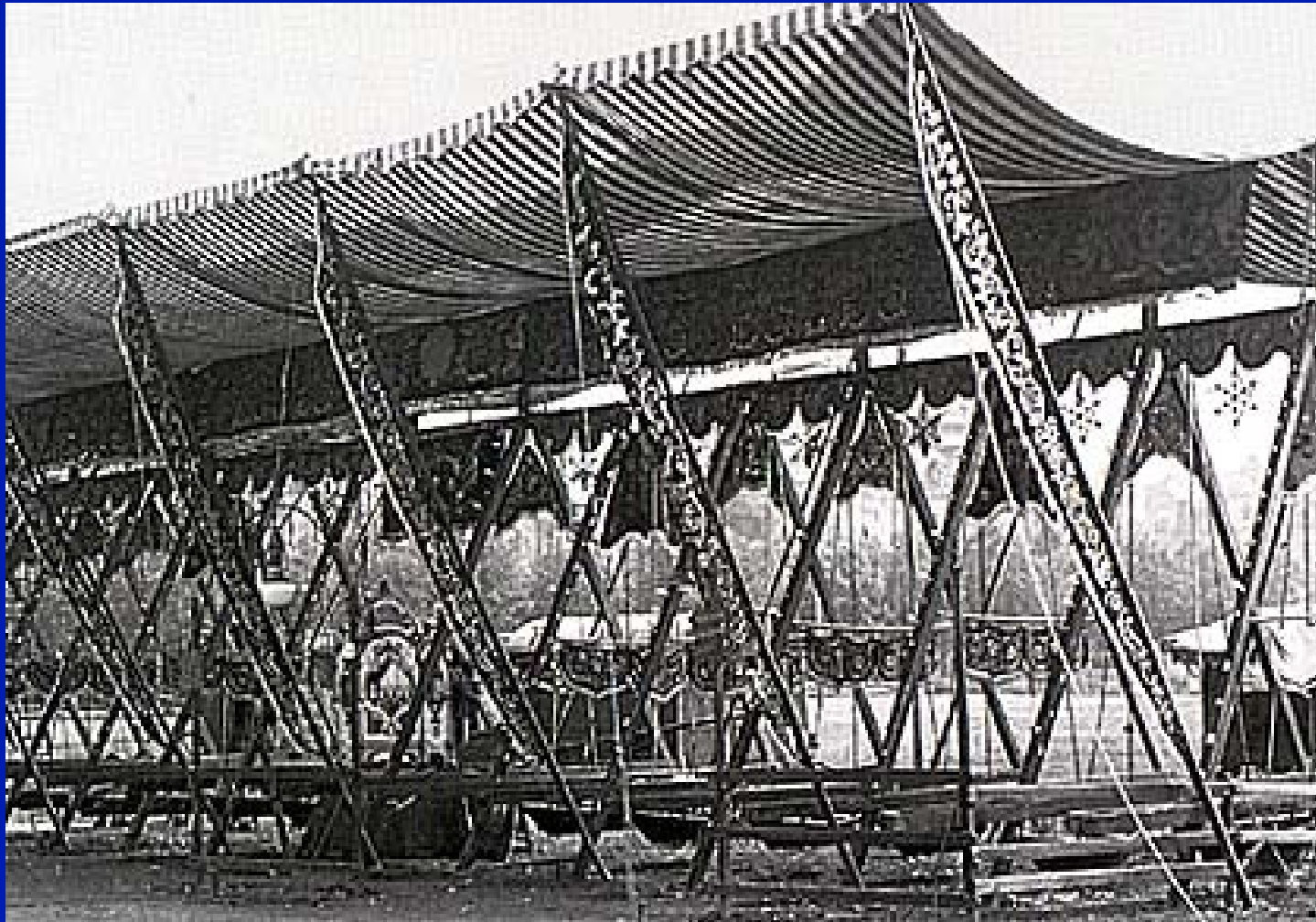


# 1925 Roller Coaster





# 1925 Swing



Schiffsschaukel Ueberäcker 1925

# 1926 Bumper Cars



Autodrom Siebold  
1926

# 1930 Chairoplane



Kettenflieger, Heinrich, ca. 1930

# 1929 TÜV Munich at the Oktoberfest

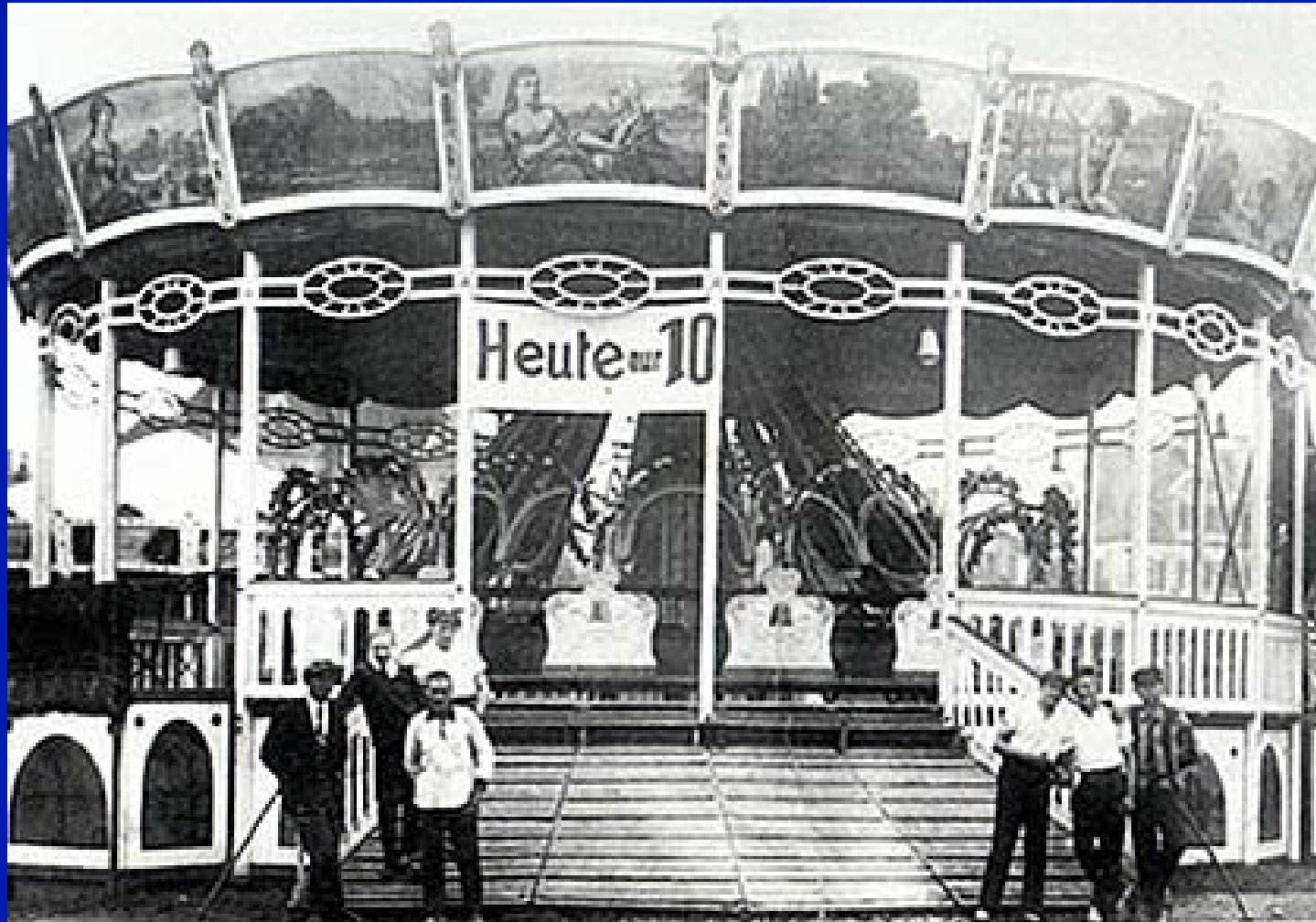
Inspection body for amusement rides since 1927.

Testing and inspection of all rides and structures at the world's largest fun fair, the Munich Oktoberfest, since 1929



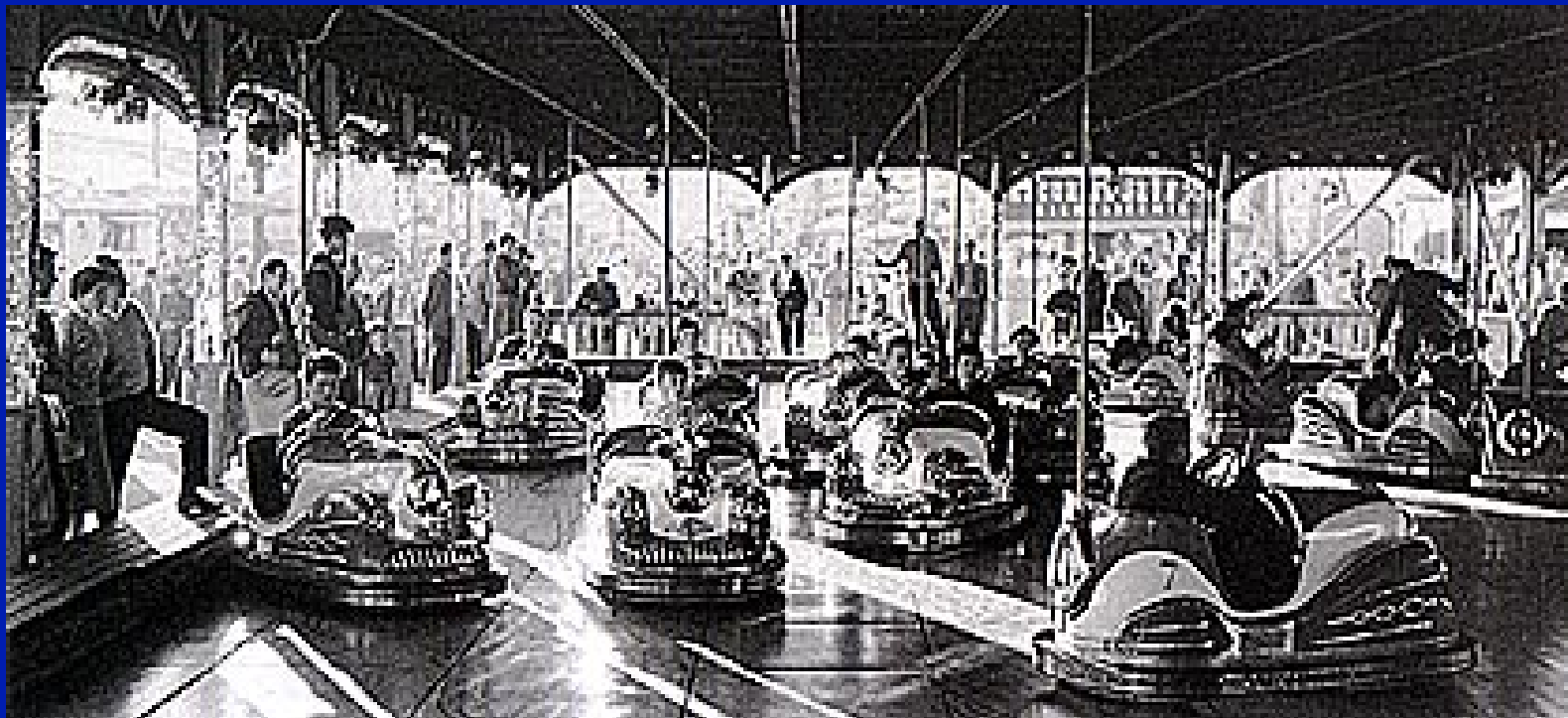


# 1950 Carousel



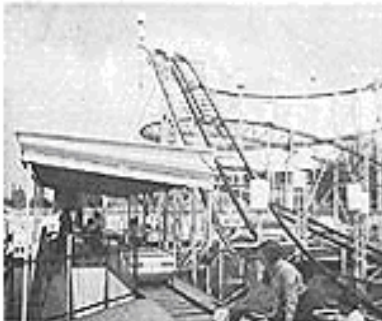
Krinoline ca. 1950

# 1955 Bumper Cars



Autoskooter 1955

# 1960's Steel Roller Coaster



## BESCHREIBUNG – SPECIFICATIONS

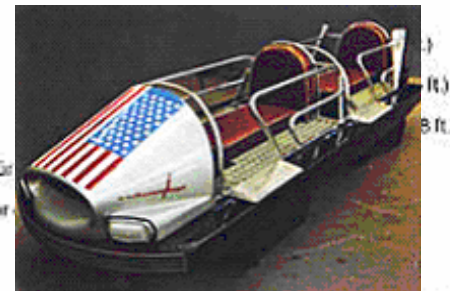
Länge – length: ca. 65 m (215 ft)  
 Tiefe – depth: ca. 22 m (72 ft)  
 Höhe – height: ca. 14,50 m (50 ft)  
 Schienenlänge – length of trackway: ca. 560 m (1837 ft)  
 Besatzung: 10 Fahrzeuge

seating: 10 cars  
 jedes für  
 each for

Anschlußwert: ca. 112 kW  
 total power required: appr. 112 kW  
 Kapazität per Stunde: ca. 1000 Pers.  
 capacity each hour: appr. 1000 persons  
 Gewicht: ca. 85 t

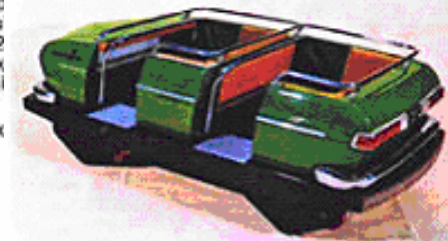
weight: 2 Bündel  
 5 Container 40"  
 appr. 63.658 long tons  
 2 bundles  
 5 containers 40 ft.

Konstruktion: mit Antrieb, Kettenaufzug, Bremsen, Rücklaufsicherungen,  
 unit: Ein- und Aussteigebahnhof, Fahrzeuge in freitragender Konstruktion  
 with drive assembly, chain elevator, brakes, anti-reverse, protection, entrance and exit station, complete vehicles.



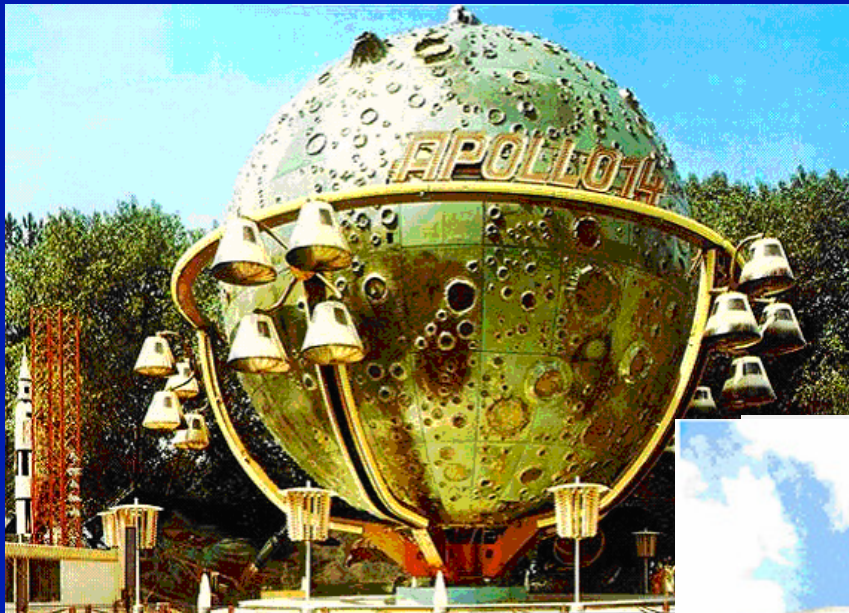
2 Bündel  
 4 Container 40"  
 appr. 74.800 long tons  
 2 bundles  
 4 containers 40 ft.

2 Bündel  
 3 Container 40"  
 appr. 62  
 2 bundles  
 3 containers 40 ft.





# 1970's Amusement Rides



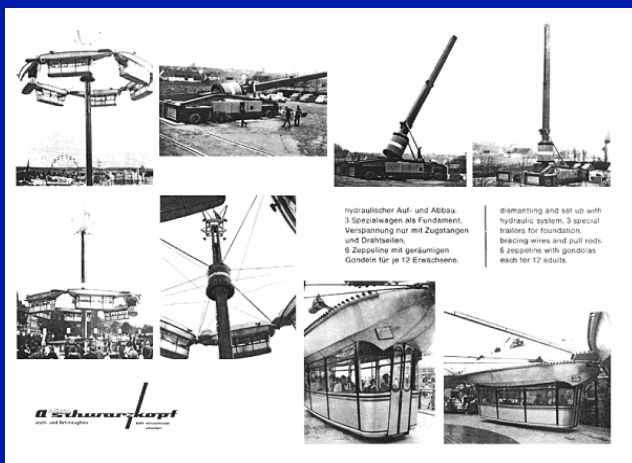
## ENTERPRISE III

Breite: ca. 20,00 m  
Tiefe ohne Fassade: ca. 20,40 m  
Tiefe mit Fassade: ca. 22,10 m  
senkrechte Flughöhe: ca. 19,50 m  
21 Fahrgastträger für je 2 Personen

## ENTERPRISE type III

width: appr. 65 ft.  
depth without front: appr. 66 ft.  
depth including front: appr. 75 ft.  
vertical height: appr. 64 ft.  
21 cabins each for two adults

**Schwarzkopf**  
Ride- und Fahrzeugbau

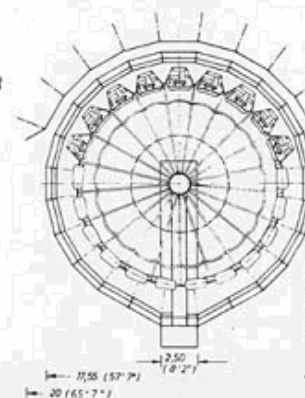
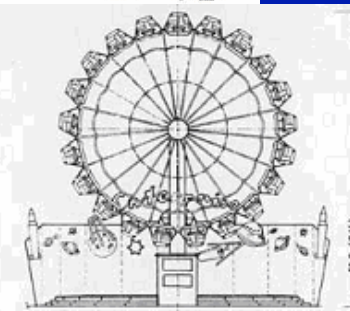


## RIDE type 3

120 kW  
30 x 14  
40 kW

42 adults  
300 adults/hour  
30 sec  
33 sec  
1.8 sec

Anfahren: ca. 10 sec. 10 stufen  
Gewicht: ca. 42 t. total weight  
Verladung: 3 Container 40' to load into 3 Containers 40'



Oberteil und Fassade auswechselbar  
mit Katapult, Ski-Flug III, Gigant,  
Flower-Wheel.

upper part and front in the background  
are interchangeable by the KATAPULT  
RIDE, SKY-FLIGHT type 3, GIGANT RIDE,  
FLOWER-WHEEL.

**Schwarzkopf**  
Ride- und Fahrzeugbau



## 1980's Amusement Ride



# TÜV SÜD at the Oktoberfest

There are often **more than 20 experts** on site to ensure that the visitors to the festival can experience breath-taking thrills and spills without any danger.

The wide range of materials **require an interdisciplinary team**. These include engineers in the specialist areas of mechanical engineering, construction and electronics/ electro technology.

Together they **check the installation conditions**, the sometimes **highly complex electrical and electronic controls** and the **hydraulic and pneumatic systems** of the rides.



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# Model Building Code (MBO)

In Germany, temporary structures and Amusement Rides are included in the building systems and building products, which are subject to building law.

# Model Building Code (MBO)

Model/  
State Building Code

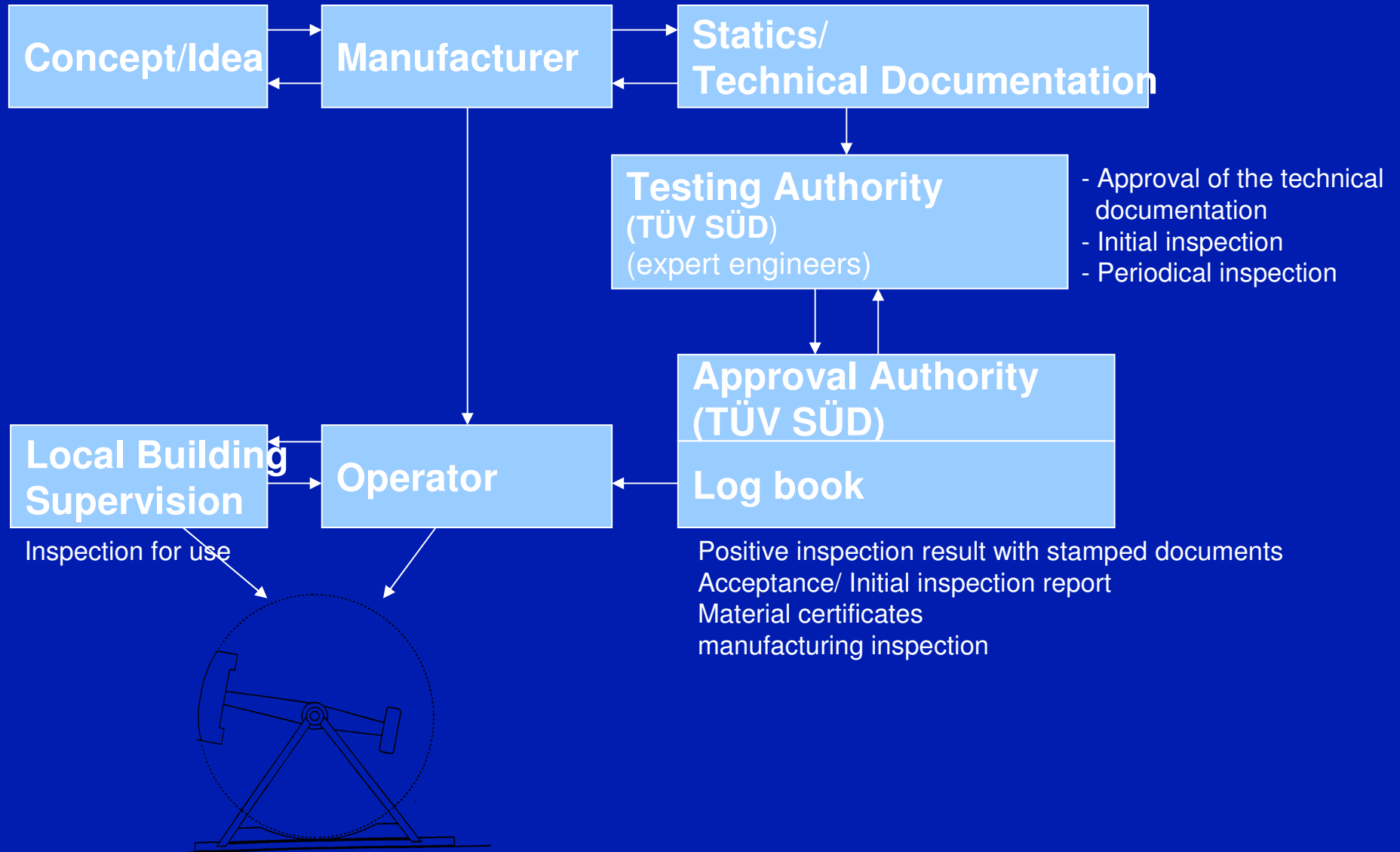
Guideline  
for the  
construction and operation  
of  
temporary structures

Approval Authority  
(TÜV SÜD)

Log book

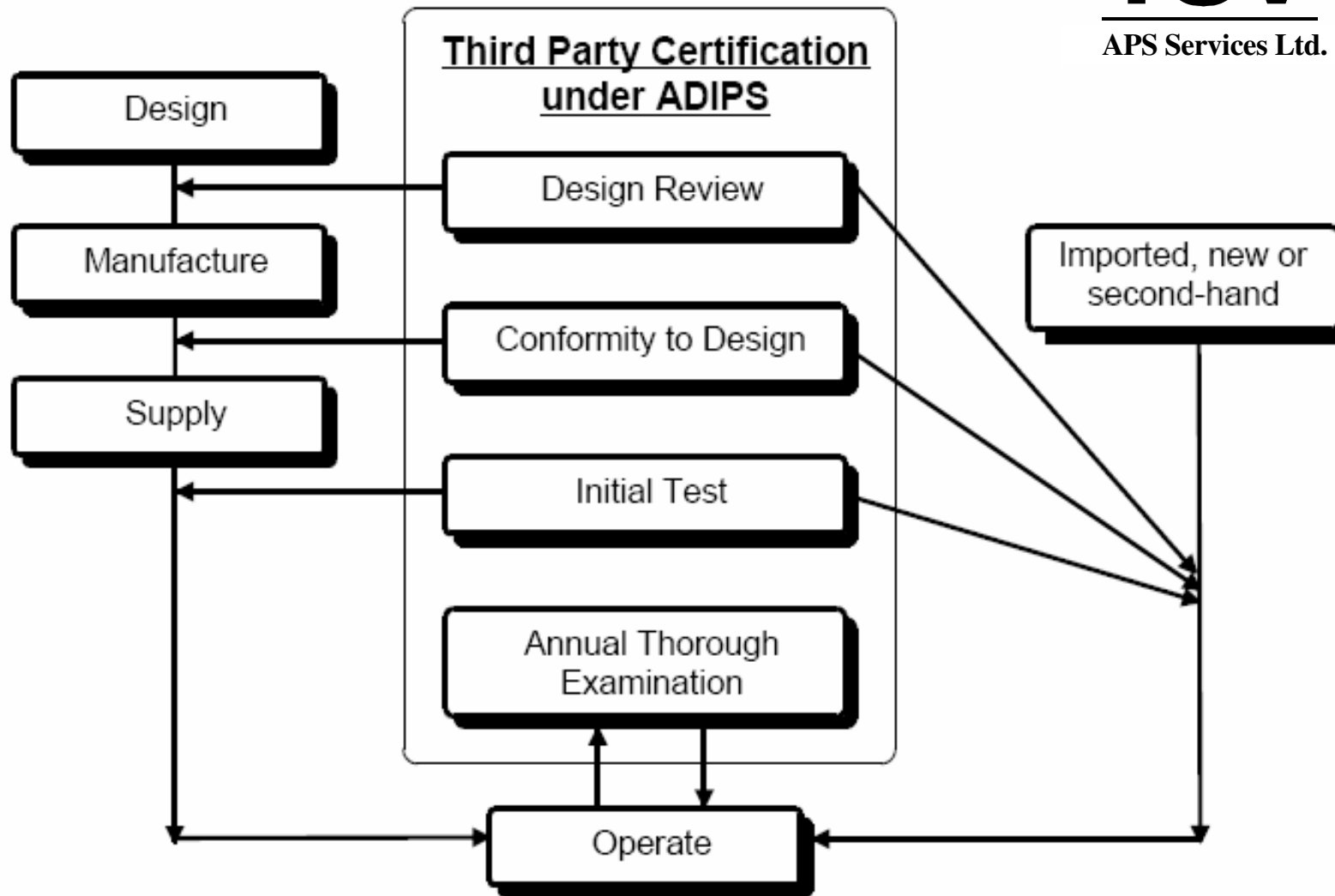
Testing Authority  
(TÜV SÜD)  
(expert engineers)

# Approval Process



## AMUSEMENT DEVICES IN GREAT BRITAIN

**TÜV**  
APS Services Ltd.





## A lot of countries:

Professional engineers according local requirements from the states.

The professional engineers create the log books.

TÜV SÜD, Munich, Log books are accepted in a lot of countries, sometimes with additional binders for national requirements. TÜV SÜD is an official Professional Engineering Office according the German Law.

# Amusement Rides and Temporary structures are regulated according national law

Due to the fact, that a European directive is missing; there is no concerted action to handle amusement rides.

# Several Member States require accreditation for the Third Party Inspection of Rides to achieve a certain quality level

## Accreditation for the Department for Amusement Parks, Rides & Structures

DAP Deutsches Akkreditierungssystem Prüfwesen GmbH  
Signatory to the Multilateral Agreement of EA  
for mutual recognition and member of IAF  
in connection with  
Deutsche Akkreditierungsstelle Technik (DATech) e.V.  
both represented in the  
**Deutschen AkkreditierungsRat**



**Accreditation**

The DAP Deutsches Akkreditierungssystem Prüfwesen GmbH herewith confirms that the  
**TÜV Industrieservice GmbH  
TÜV Süd Gruppe  
Zertifizierungsstelle Fliegende Bauten**  
Westendstraße 199  
80686 München

is competent under the terms of DIN EN 45011 to carry out conformity assessments in the area of  
**Amusement Rides and Leisure Devices**

for the areas of certification listed in the annex.  
The accreditation is valid from 2004-09-17 to 2007-05-02.  
DAR registration number: **DPT-ZE-3510.01**  
Berlin, 2004-09-17

*p.p. Nallerau*  
Dr.-Ing. K. Berner  
Managing Director  
DAP Deutsches Akkreditierungssystem  
Prüfwesen GmbH



*Th. Facklam*  
Dr.-Ing. Th. Facklam  
Managing Director  
Deutsche Akkreditierungsstelle  
Technik (DATech) e.V.

Translation for information purposes only. The German certificate is authoritative.  
See notes overleaf. 2nd issue

DAP Deutsches Akkreditierungssystem Prüfwesen GmbH  
in connection with  
Deutsche Akkreditierungsstelle Technik (DATech) e.V.  
both represented in the  
**Deutschen AkkreditierungsRat**



**Accreditation**

The DAP Deutsches Akkreditierungssystem Prüfwesen GmbH herewith confirms that the  
**TÜV Industrieservice GmbH  
TÜV Süd Gruppe  
Inspektionsstelle Fliegende Bauten**  
Westendstraße 199  
80686 München

with its  
**Inspection body type A**

is competent under the terms of DIN EN 45004 to carry out inspections in the areas of  
**Amusement Rides and Leisure Devices (new and in-service), the determination of their conformity with specific requirements and - on the basis of professional judgement - general requirements**

for the inspection fields listed in the annex.  
The accreditation is valid from 2004-09-17 to 2007-05-02.  
DAR registration number: **DPT-IS-3510.01**  
Berlin, 2004-09-17

*p.p. Nallerau*  
Dr.-Ing. K. Berner  
Managing Director  
DAP Deutsches Akkreditierungssystem  
Prüfwesen GmbH



*Th. Facklam*  
Dr.-Ing. Th. Facklam  
Managing Director  
Deutsche Akkreditierungsstelle  
Technik (DATech) e.V.

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See notes overleaf. 1st issue

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# Technology

Providing a **SAFE AND RELIABLE RIDE TECHNOLOGY**  
a ride design covers:

- A state-of-the-art technology
- The experiences made of accidents and incidents worldwide



An indication that the  
design is safe and reliable:

An independent third party  
confirms that the design  
fulfils the requirements of  
the respective standards.



# Technology

Ride Technology can be considered as state-of-the-art when it is in Compliance with up-to-date Standards.

The design must be validated on the entire Installation after commissioning, but before putting in operation.

Regular inspections are required to maintain the state-of-the-art technology.



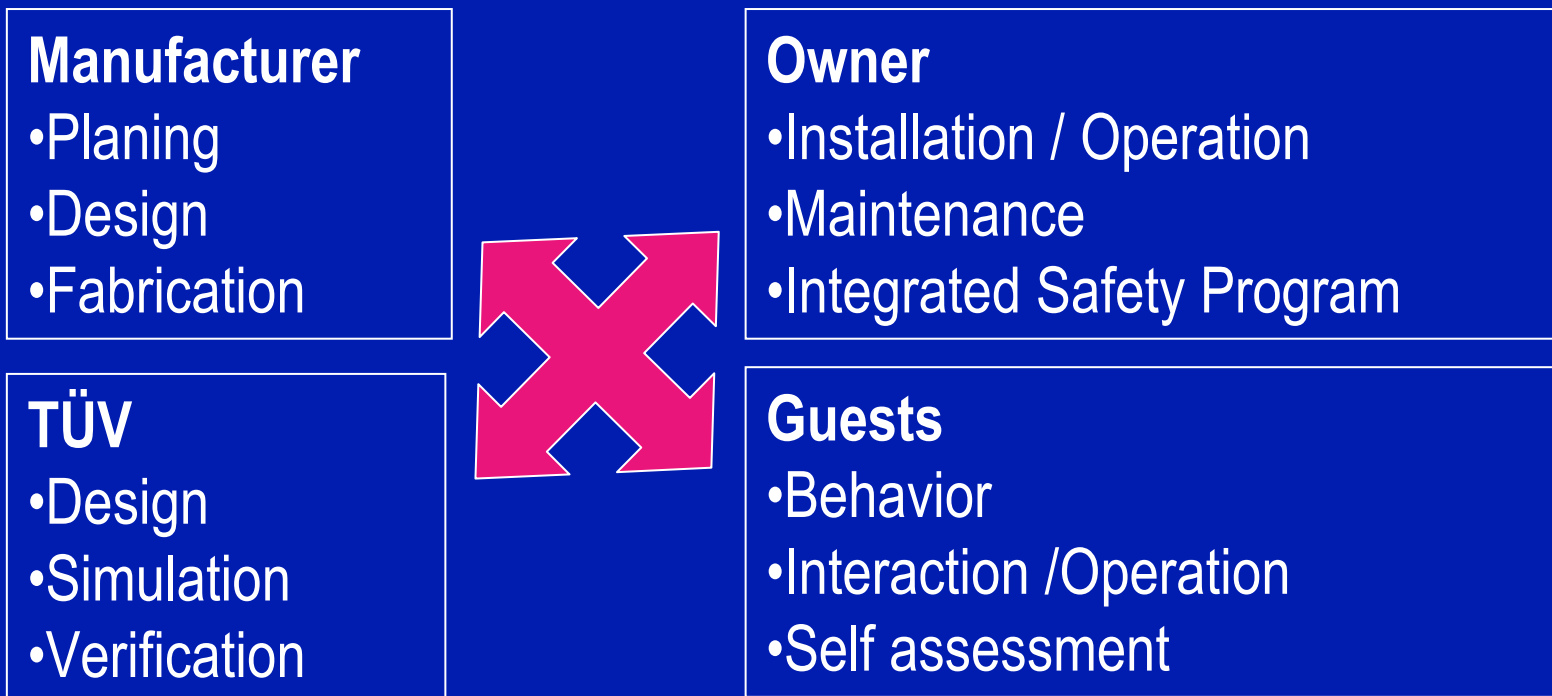
# **CEN HAS ADDRESSED MAIN FIELDS FOR STANDARDIZATION TO EFFECTIVELY ENHANCE RIDE SAFETY**

- **Design**
- **Manufacture , Construction**
- **Initial Third Party Review and  
Acceptance Test**
- **Maintenance and Preventive  
Inspections**
- **Regular External Third Party  
Inspection**



# EN 13814 has Related Responsibilities of the Involved Parties to Ensure Safety

- Safety is a Coordination of several Factors
- Interrelation of the Parties involved with Ride Safety



# Ride Certification Scheme

## Ride Certification

Ride  
Evaluation

- feasibility
- pre Review

Design  
Review

- structural
- mechanical
- electrical

Manu-  
factu-  
ring  
Inspection

Accep-  
tance  
Test

## Inspection

Thorough Inspection

...

Thorough Inspection

...

Extended Regular  
Inspection



Life Cycle of Amusement Ride

time

# Ride Certification Scheme

System  
Engineering

Structural  
Engineering



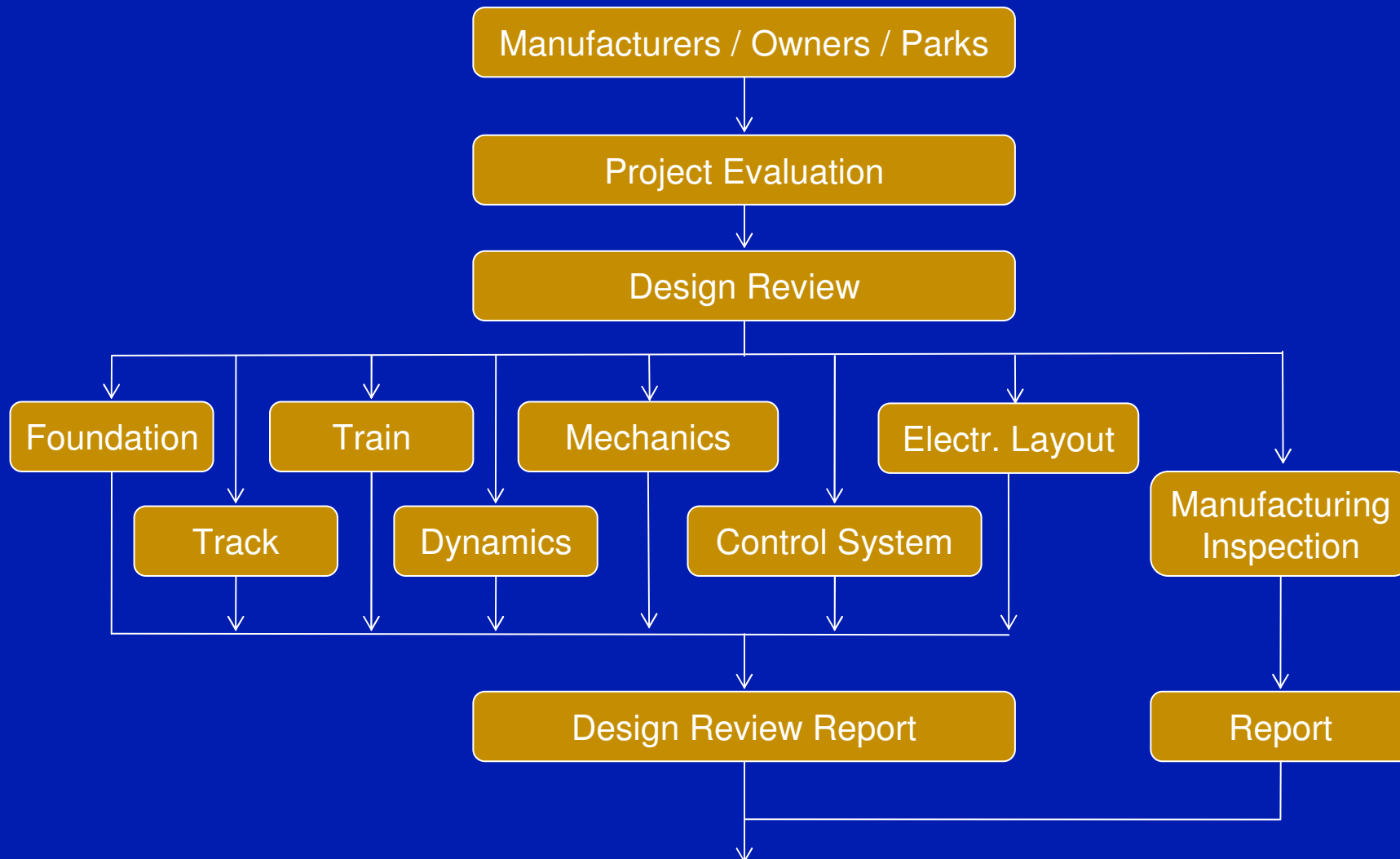
Mechanical  
Engineering

Electrical  
Engineering



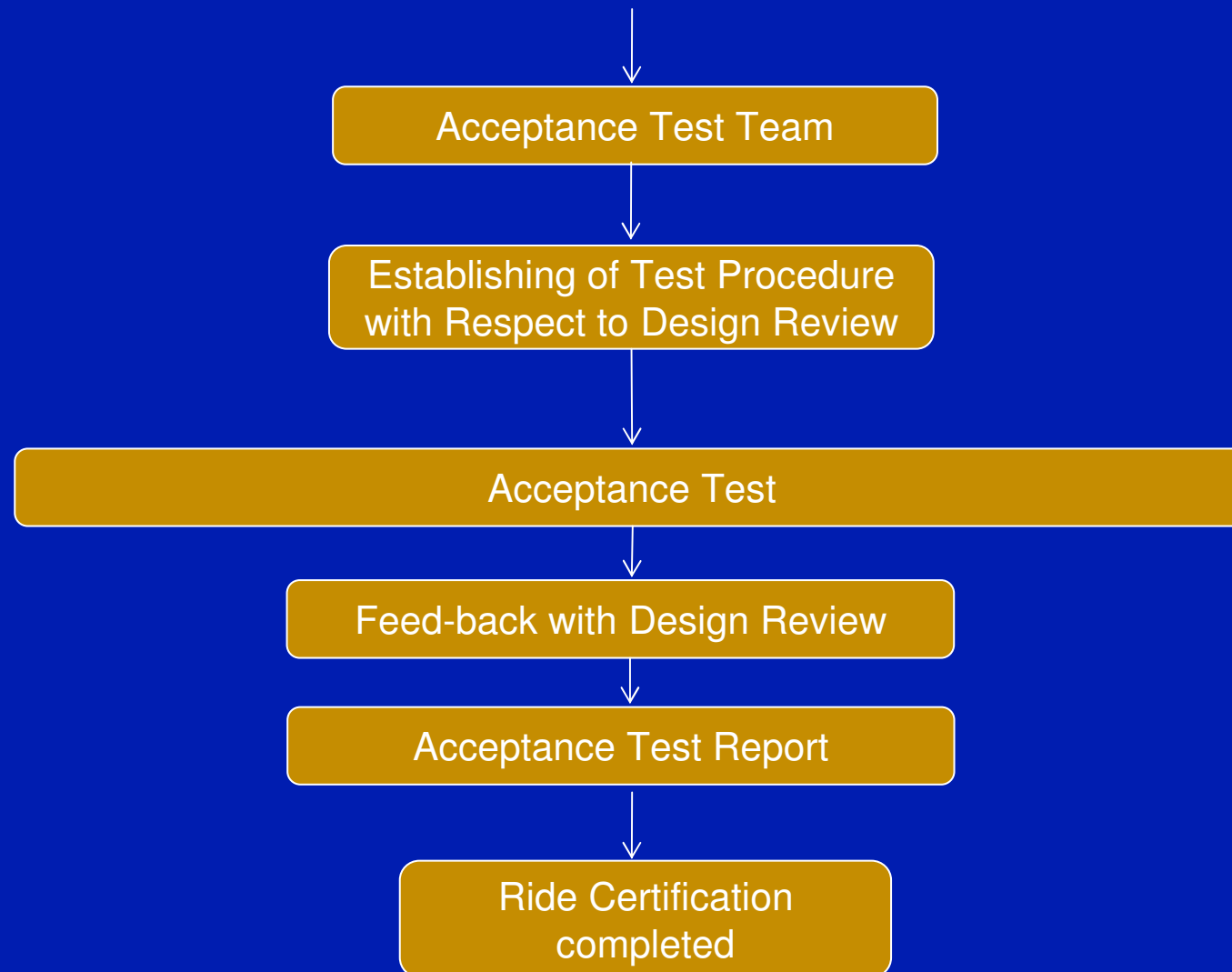
# TÜV SÜD Ride Certification Scheme

## Process of Ride Certification



# TÜV SÜD Ride Certification Scheme

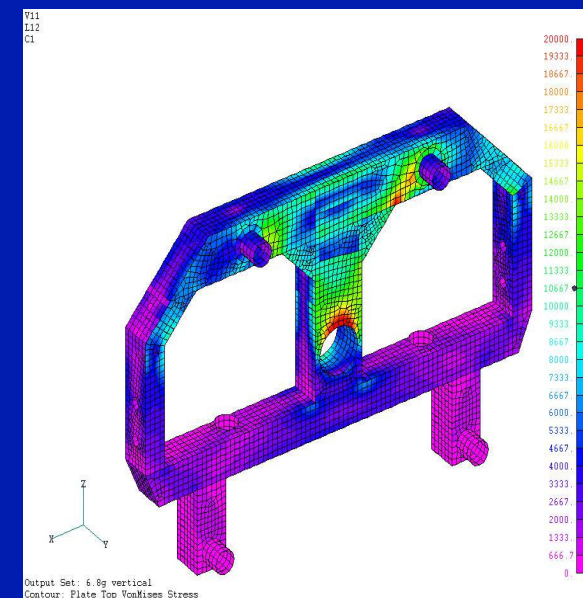
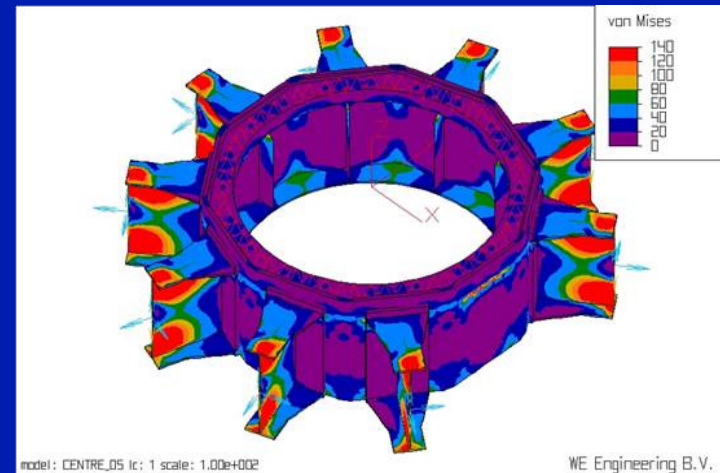
## Process of Ride Certification (cont.)



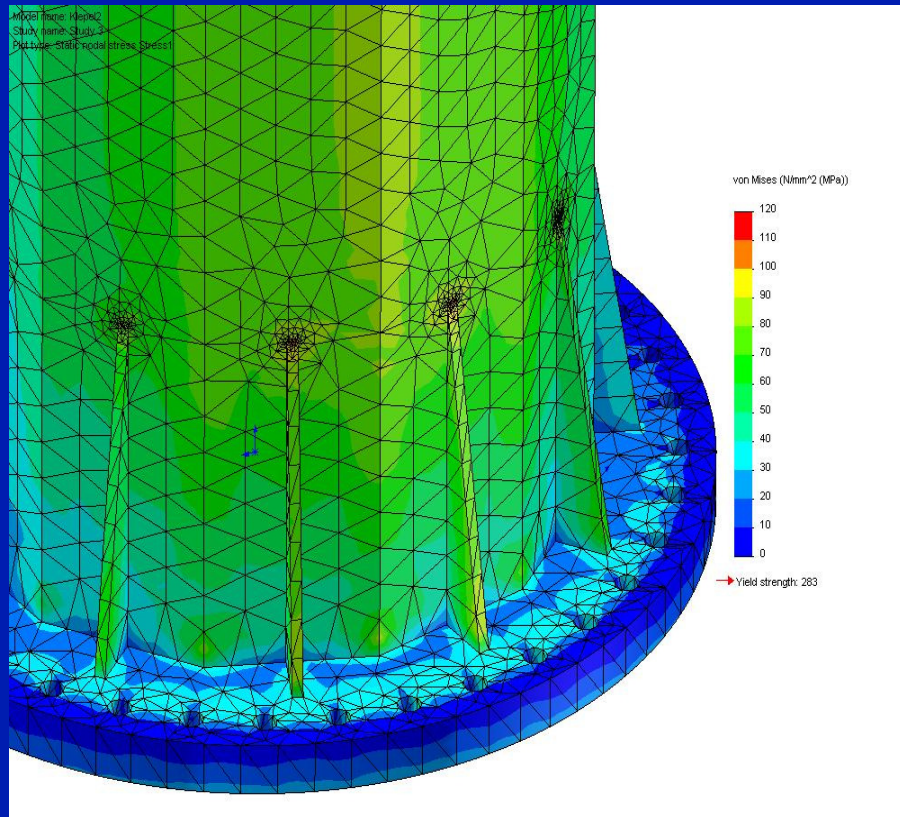
# Thorough Design Review

## Verifications of

- Kinematic-simulations
- Modal Analysis
- Mechanical Elements:  
Fatigue Shafts, Axles, Gear boxes
- FEM and Beam Elements  
Calculations to DIN
- Welded Units to DIN
- Life-Cycle Calculations
- Steel Structures and Foundations



# Design and Analysis



DIN 15 018 Teil 1 Seite 25

**Tabelle 29. Kerbfall K 1 — mäßige Kerbwirkung (Fortsetzung)**

Ordnungs-Nr	Beschreibung und Darstellung	Sinnbild
114	Mit Stumpfnah-Normalgüte quer verbundene Stegbleche	$\nabla$ P oder P 100 $\times$ P oder P 100
121	Mit Stumpfnah-Normalgüte längs zur Kraft- richtung verbundene Teile	$\nabla$ $\times$
123	Mit Kehlnah-Normalgüte längs zur Kraft- richtung verbundene Teile	$\nabla$ $\nabla$
131	Durchlaufendes Teil, an das quer zur Kraft- richtung Teile mit durchlaufender K-Nah mit Doppelkehlnah-Sondergüte angeschweißt sind	$\nabla$ $\nabla$ $\nabla$
132	Durchlaufendes Teil, an das quer zur Kraft- richtung Scheiben mit K-Nah mit Doppelkehlnah-Sondergüte angeschweißt sind	$\nabla$ $\nabla$ $\nabla$
133	Druckgurte und Stegbleche, an die Quer- schotte oder Steifen mit abgeschnittenen Ecken mit Doppelkehlnah-Sondergüte angeschweißt sind. Die Einfröfung in den Kerbfall gilt nur für den Bereich der Doppelkehlnähte.	$\nabla$ $\nabla$ $\nabla$
154	Mit K-Nah mit Doppelkehlnah-Sonder- güte verbundene Steg- und gekrümmte Gurtbleche	$\nabla$ $\nabla$ $\nabla$

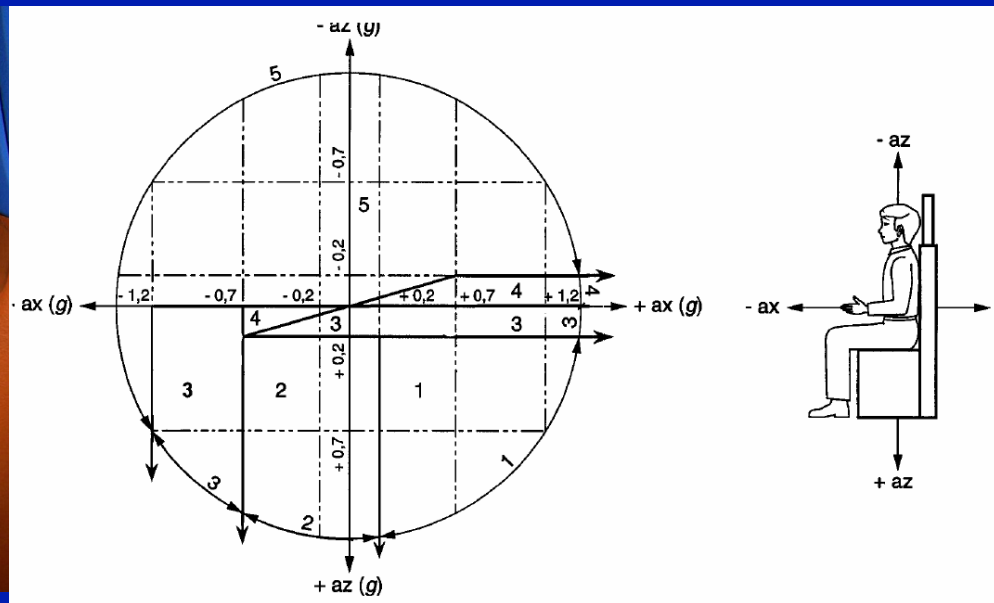
**Tabelle 30. Kerbfall K 2 — mittlere Kerbwirkung**

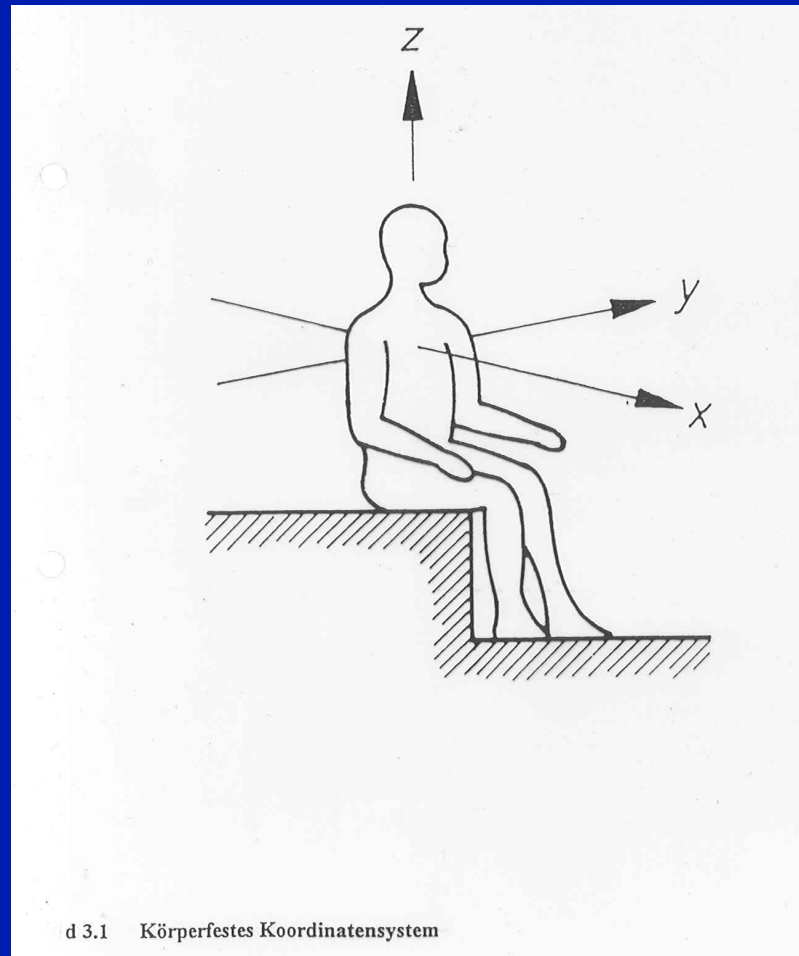
Ordnungs-Nr	Beschreibung und Darstellung	Sinnbild
211	Mit Stumpfnah-Sondergüte quer zur Kraft- richtung verbundene Teile aus Formstahl oder Stabstahl, außer Flachstahl	$\nabla$ P 100 $\nabla$ P 100

# Technology of Rides

EN 13814 has created the frame for the safety requirements in the industry.

E.g. ergonomic and safety requirements for restraints have created a big improvement in safety of rides.





## Acceleration Measurements

- Accelerometer Tests
- Verification of Fabrication Accuracy
- Ergonomics
- Evacuation Procedures
- Compliance to Standards



# Ride Design Verification

Mechanical Engineers
Structural Engineers
Welding Engineers
Electrical Engineers

## System Engineering

- Material Certification and Testing

- Evacuation Procedures

- Boarding and Unboarding

- Ergonomics

- Medical Assessment

- Prototype Seat and Restraint Testing

- Accelerations

- Welding Engineering

- Risk Analysis

- FMEA

# Ride Design Verification

## Structural Engineering

- Foundation
- Steel Structure
- Static Calculation
- Stability
- Fatigue Calculation
- Welding Structure

## Mechanical Engineering

- Pneumatic
- Hydraulic
- Kinetic and Dynamics
- Machinery Parts
- Drive Units, Gear Boxes
- Cables
- Fatigue Calculation

## Electrical Engineering

- Electrical Layout
- System Analysis
- PLC-Program
- Lightning Protection
- Safety PLC-Program

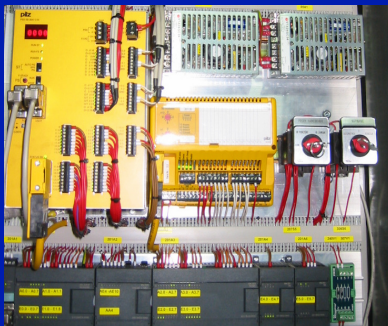
# Independent Yearly Inspections



Structural Engineering



Mechanical Engineering



Electrical Engineering

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## Rules and laws need to be enforced

### **Former park officials accept blame for fatal roller coaster accident**

*Daily Yomiuri, July 15, 2008*

"According to the indictment, Ito and Tatebe postponed the regular inspection that should have been conducted no later than March 18, 2007, on the roller coaster Fujin-Raijin II and allowed it to continue operating, although a visible crack on an axle of its second car was confirmed at the end of November 2006. The prosecutor said their negligence resulted in the axle breaking, leading to the death of Yoshino Kogawara and injuries to 12 other passengers."



# Cobra Incident

Initial Inspection and Regular Thorough Inspections  
need to be performed to the full scope of EN 13814





## **Man dead after fall from roller coaster**

(Saturday, February 14, 2009)

A 37-year-old man was killed after falling 30-40 feet from a roller coaster at Star City theme park in Pasay City, Philippines.

The accident happened on a compact, inverted-type roller coaster called the Star Flyer.

Park officials say that the ride's safety system was operating properly at the time of the incident, and that it is impossible for someone to fall from the ride unless he intentionally eluded the restraint harness before it was locked.

...

Dangerous Behavior beyond the scope of the standard



## Dangerous Behavior beyond the scope of the standard

...

According to a ride attendant, the victim had asked whether falling from the ride would be fatal.

Several witnesses reported seeing the man escaping from his harness as the ride began.

**The man's restraint device was found in the locked position after the incident.**



Total Failure will not occur if all design rules and inspection requirements are followed correctly





Fundamental Design Principles and Requirements are shown in the Standard



Thank you very much for your attention.

[www.tuev-sued.de](http://www.tuev-sued.de)

