Dipl.- Ing. Univ.
Stefan Kasper

DEPARTMENT FOR AMUSEMENT RIDES AND LEISURE PARKS, CERTIFICATION BODY FOR RIDES

TÜV SÜD Industrie Service GmbH

Department IS-FSF

Westendstraße 199
D - 80686 München

Tel. ++49-(0)89-5791-1943
Fax ++49-(0)89-5791-2022
mobile ++49-(0)160 70 43 527

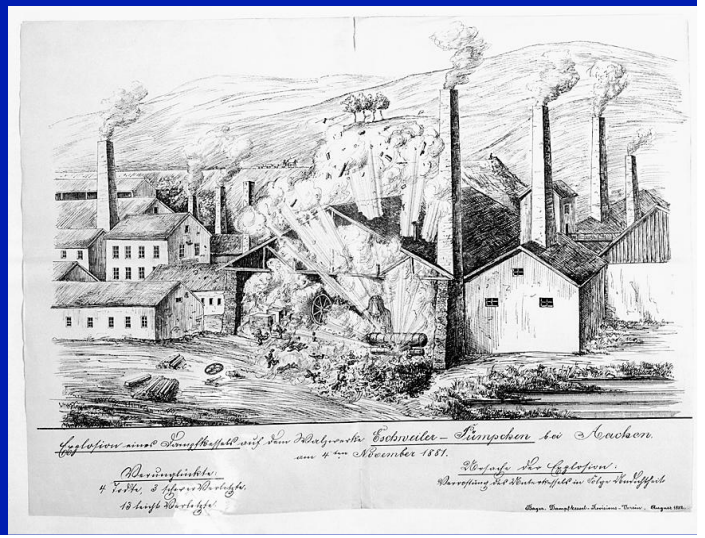
Stefan.Kasper@tuev-sued.de

Content

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.



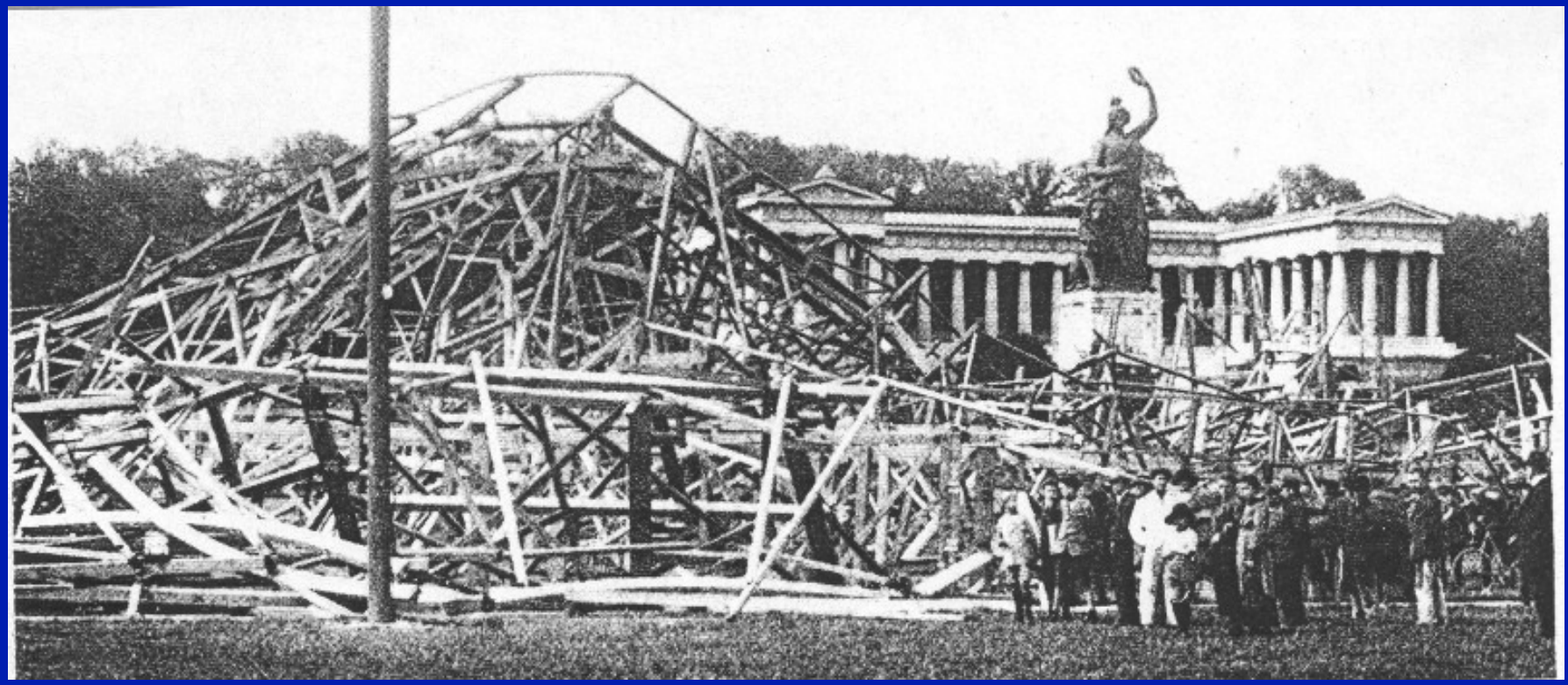
1899 Russian Swing (Ferris Wheel)

1906 Toboggan

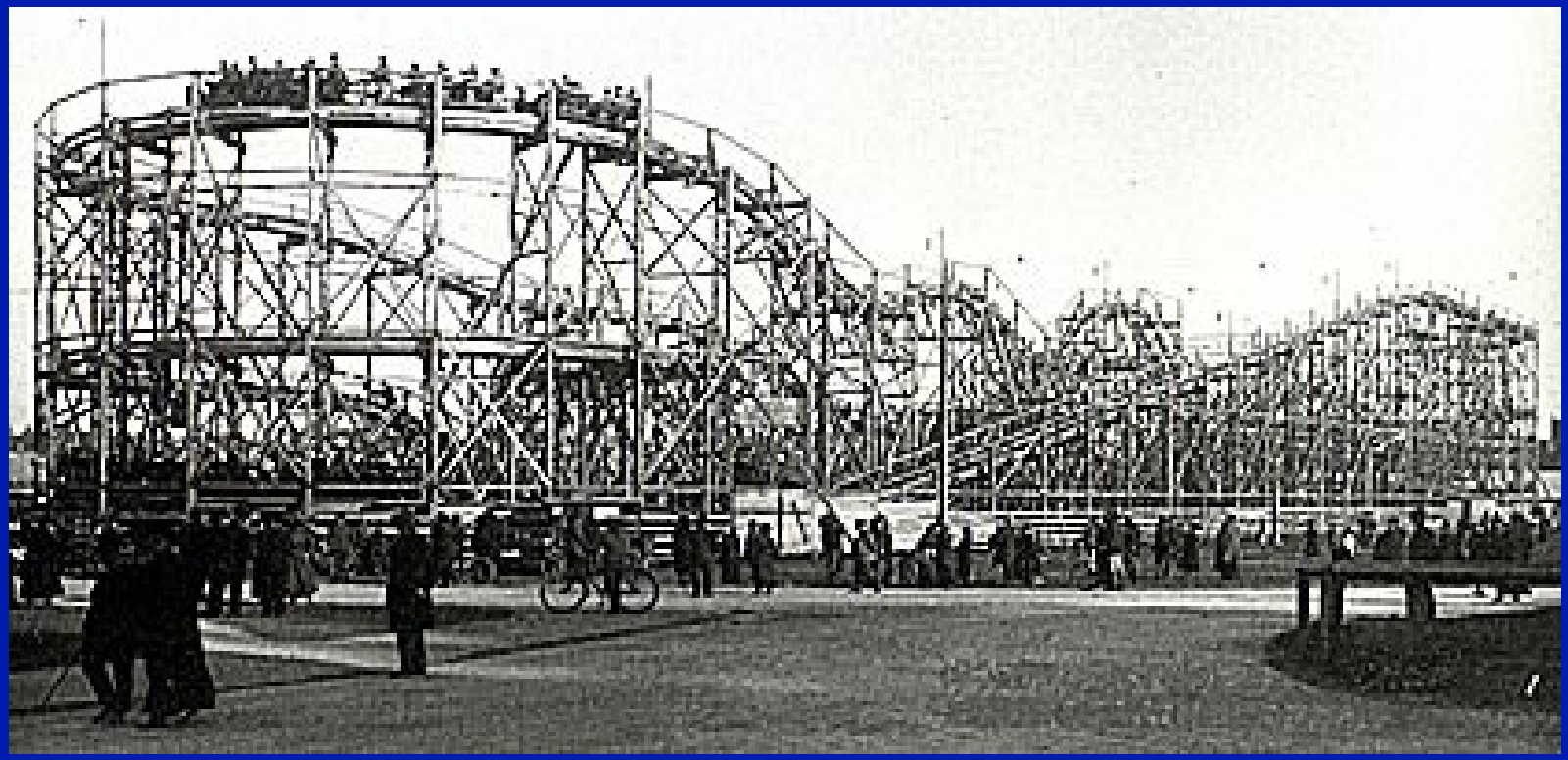
1910 First Roller Coaster

amerikanische „Figur 8 Bahn", die Achterbahn.

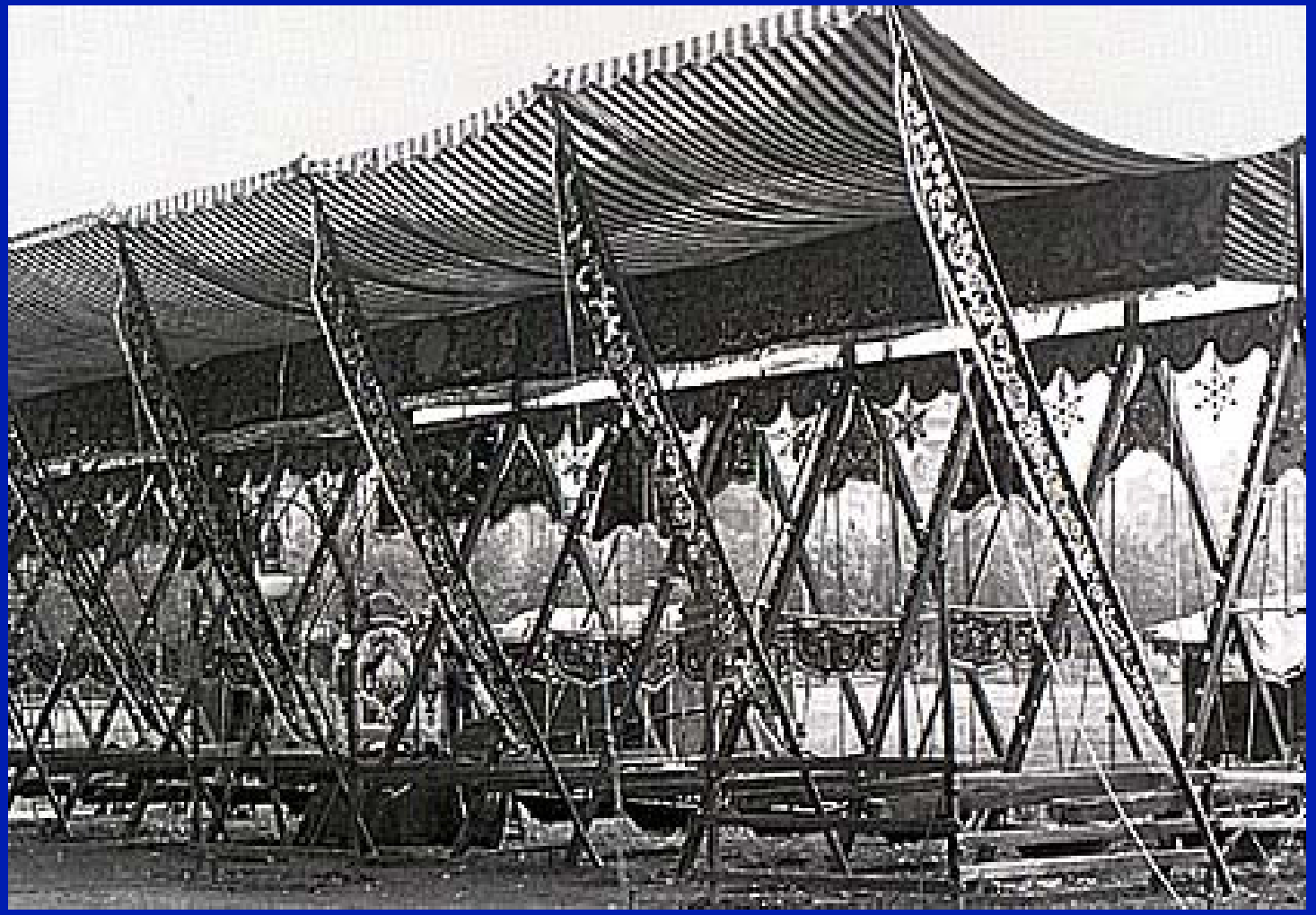
1921 Collapse of the Roller Coaster



1925 Roller Coaster



1925 Swing



Schiffsschaukel Ueberäcker 1925

1926 Bumper Cars

Autodrom Siebold
1926

1930 Chairoplane

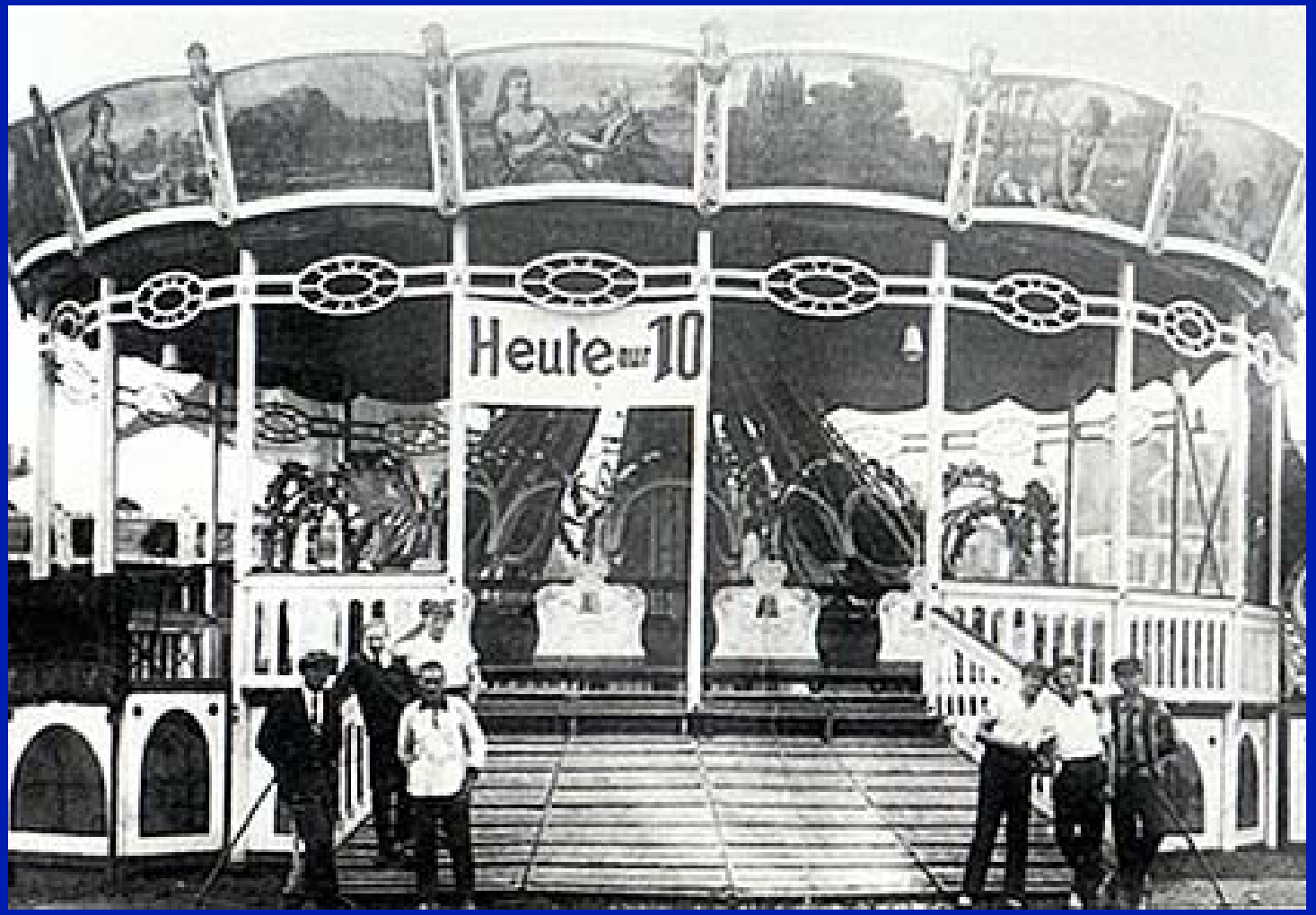
Kettenflieger, Heinrich, ca. 1930

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

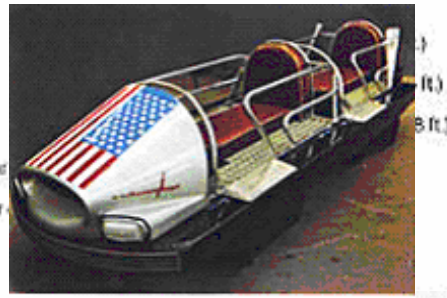
1955 Bumper Cars

Autoskooter 1955

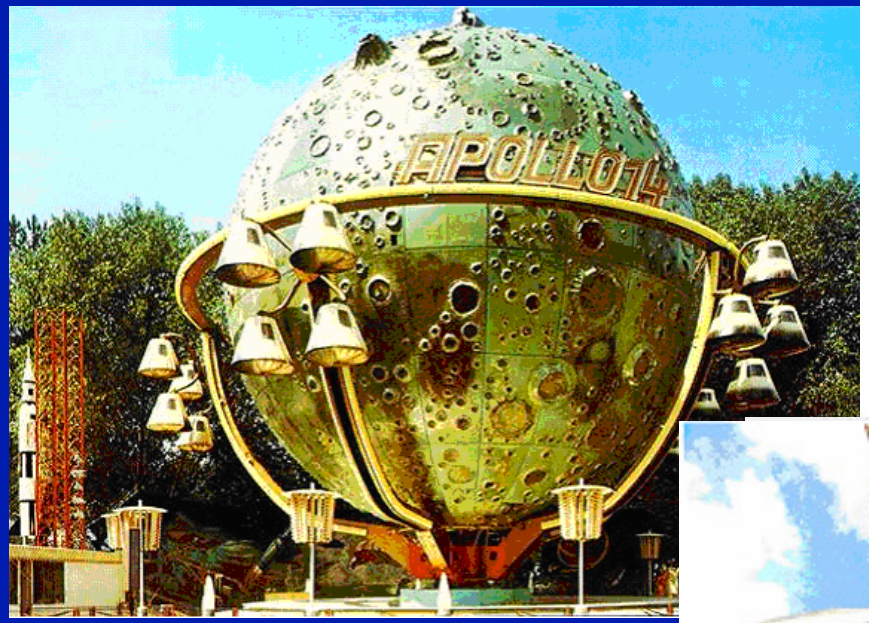
1960‘s Steel Roller Coaster

BESCHREIBUNG – SPECIFICATIONS

Länge – lenght:	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		
	jedes für		
seating:	10 cars		
	each for		
Anschlußwert: total power required:	ca. 112 kW appr. 112 kW		
Kapazität per Stunde: capacity each hour:	ca. 1000 Pers. appr. 1000 persons		
Gewicht:	ca. 85 t		
	2 Bündel	2 Bündel	2 Bünd
	5 Container 40"	4 Container 40"	3 Conta
weight:	appr. 83.658 long tons	appr. 74.800 long tons	appr. 62
	2 bundles	2 bundles	2 bundl
	5 containers 40 ft.	4 containers 40 ft.	3 contai
Konstruktion:	mit Antrieb, Kettenaufzug, Bremsen, Rücklaufsicherungen,		
unit:	Ein- und Ausstiegsbahnhof, Fahrzeuge in freitragender Konstruktio		
	with drive assembly, chain elevator, brakes, anti-reverse, protection, entrance and exit station, complete vehicles.		



1970‘s Amusement Rides

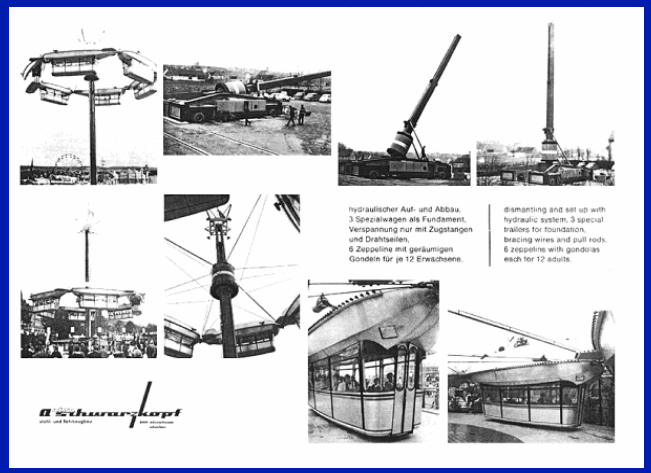


ENTERPRISE III

Breite:	ca. 20,00 m
Tiefe ohne Fassade:	ca. 20,40 m
Tiefe mit Fassade:	ca. 23,10 m
senkrechte Flughöhe:	ca. 19,50 m
21 Fahrgastträger für je 2 Personen	

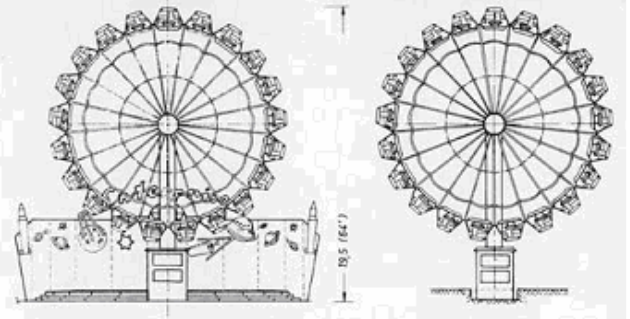
ENTERPRISE type III

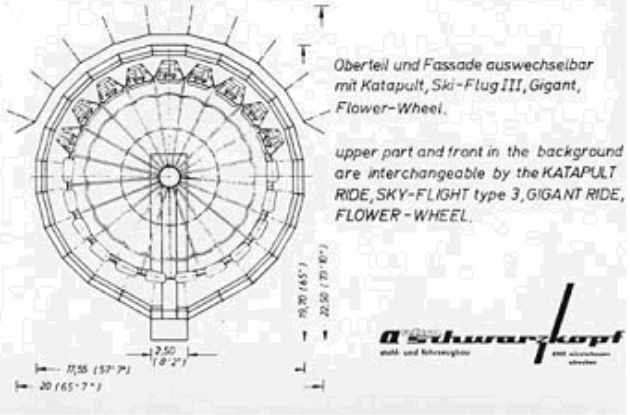
width:	appr. 65 ft.
depth without front:	appr. 66 ft.
depth including front:	appr. 75 ft.
vertical height:	appr. 64 ft.
21 cabins each for two adults	



hydraulischer Auf- und Abbau, 3 Spezialwagen als Fundament, Verspannung nur mit Zugstangen und Drahtseilen, 6 Zeppeline mit geräumigen Gondeln für je 12 Erwachsene.

dismantling and set up with hydraulic system, 3 special trailers for foundation, bracing wires and pull rods, 6 zeppelins with gondolas each for 12 adults.





RIDE type 3

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.

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**.

Content


Belfast
Leeds
Dublin
Birmingham
Den Haag
Amsterdam
London
Brussel
Luxembou
Stuttgart
Basel
Bern
Vadu
Lyon
Ljubljana
Zagreb
Wien
Budapest
Beograd
Sarajevo
Tiran?
Napoli
Toulouse
Marseille
Barcelona
Porto
Madrid
Lisboa
Algier
Tunis
Tanger
Oran
km 100 200 300 400

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

Concept/Idea

Manufacturer

Statics/ Technical Documentation

Testing Authority
(TÜV SÜD)
(expert engineers)

- Approval of the technical documentation
- Initial inspection
- Periodical inspection

Approval Authority (TÜV SÜD)

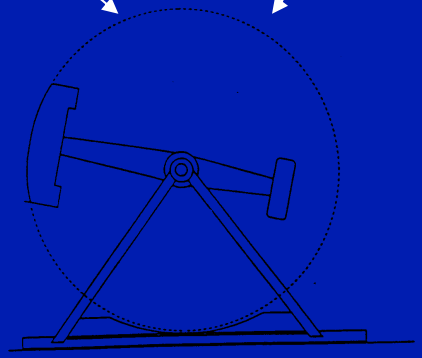
Log book

Local Building Supervision

Operator

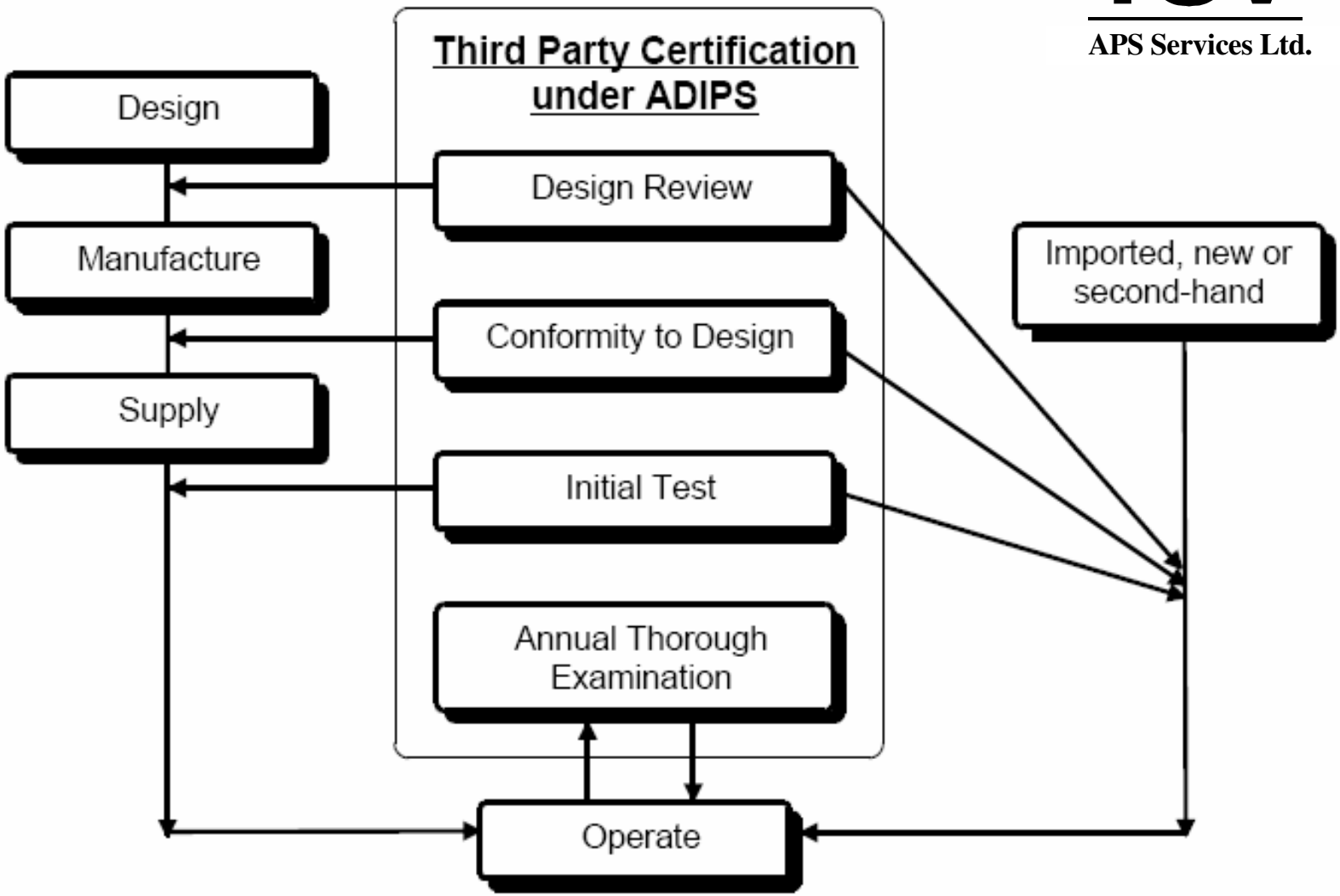
Inspection for use

Positive inspection result with stamped documents
Acceptance/ Initial inspection report
Material certificates
manufacturing inspection



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

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

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

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

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.

1st issue

Content

1. **History**
2. Operation Authorization
3. Ride Certification Scheme
4. Risks- Incidents- Accidents

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

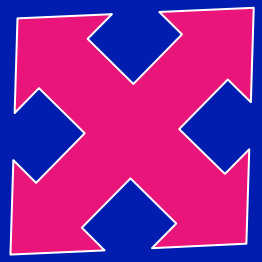
- Design
- Manufacture , Construction
- Initial Third Party Review and Acceptance Test
- Maintenance and Preventive Inspections
- Regular External Third Party Inspection

EN 13814 has Related Responsibilites of the Involved Parties to Ensure Safety

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

Manufacturer
- Planing
- Design
- Fabrication

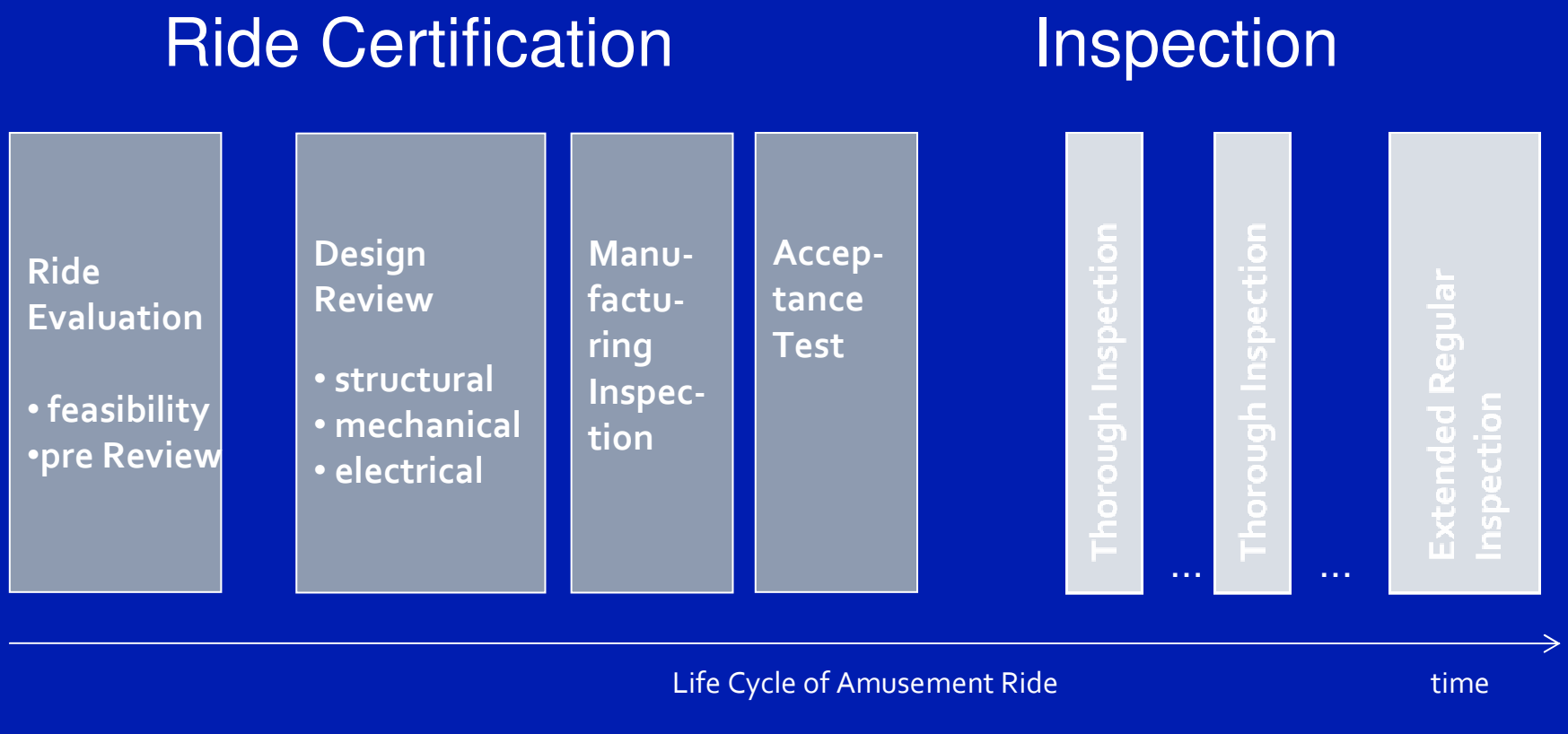
TÜV
- Design
- Simulation
- Verification



Owner
- Installation / Operation
- Maintenance
- Integrated Safety Program

Guests
- Behavior
- Interaction /Operation
- Self assessment

Ride Certification Scheme



Ride Certification Scheme

System Engineering

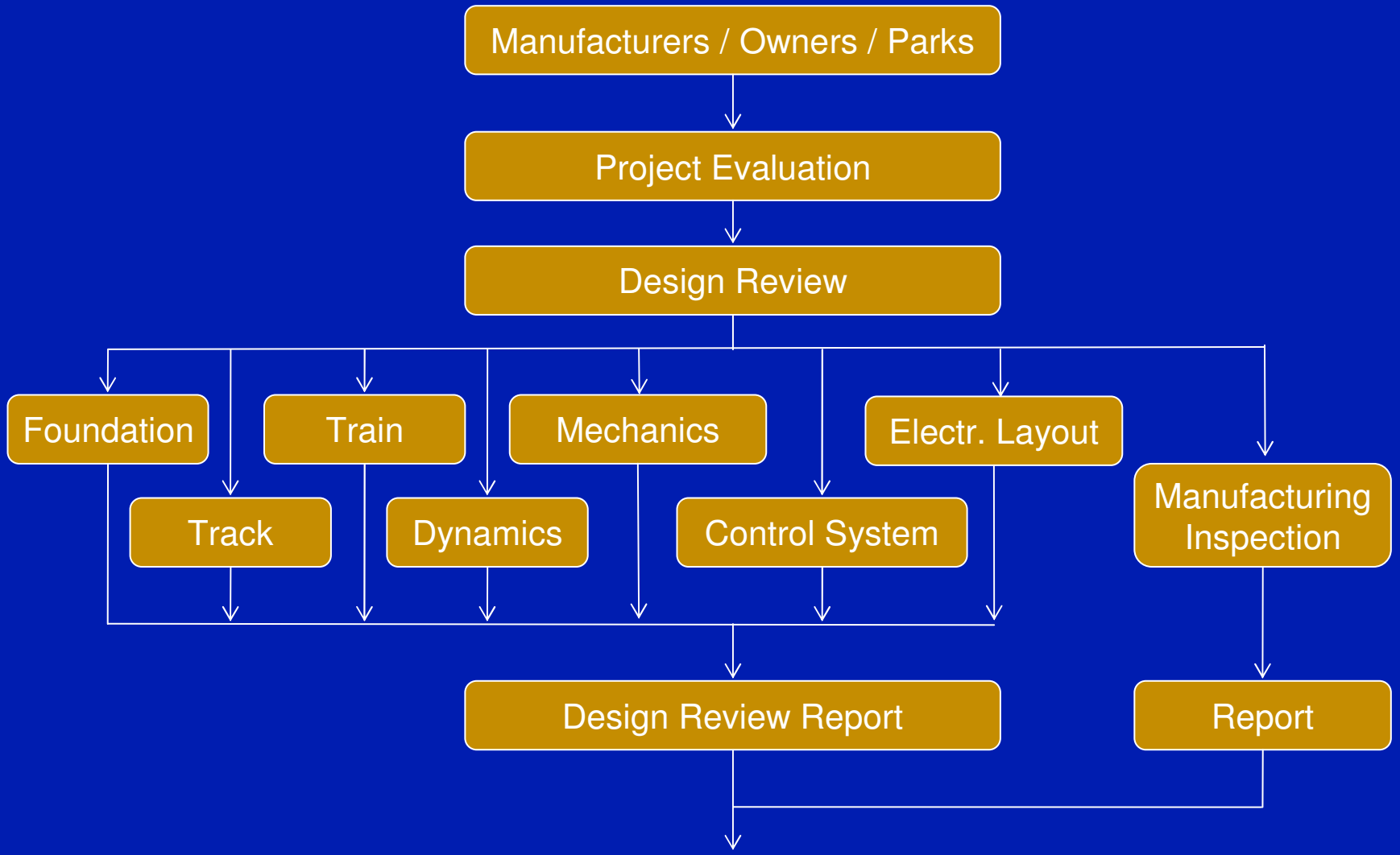
Structural Engineering

Mechanical Engineering

Electrical Engineering

TÜV SÜD Ride Certification Scheme

Process of Ride Certification



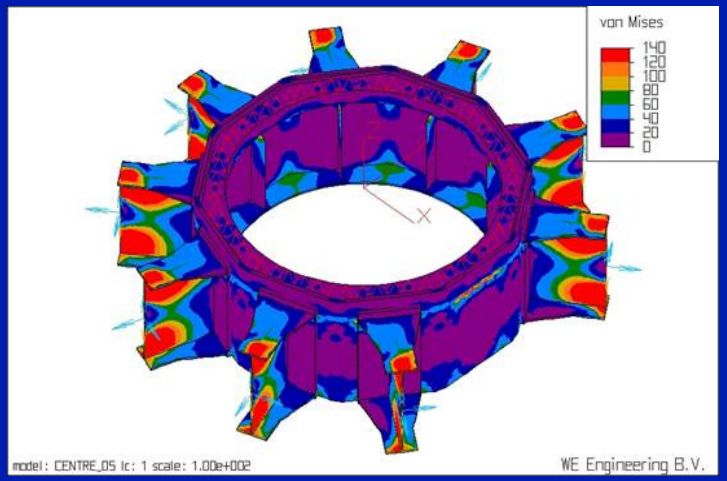
TÜV SÜD Ride Certification Scheme

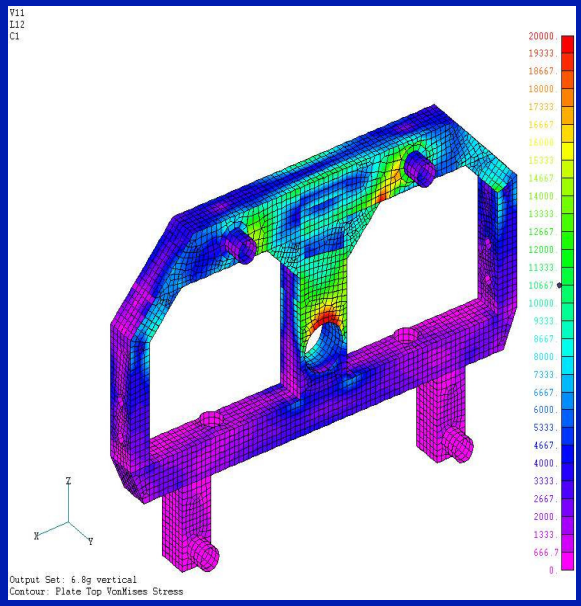
Process of Ride Certification (cont.)

Thorough Design Review

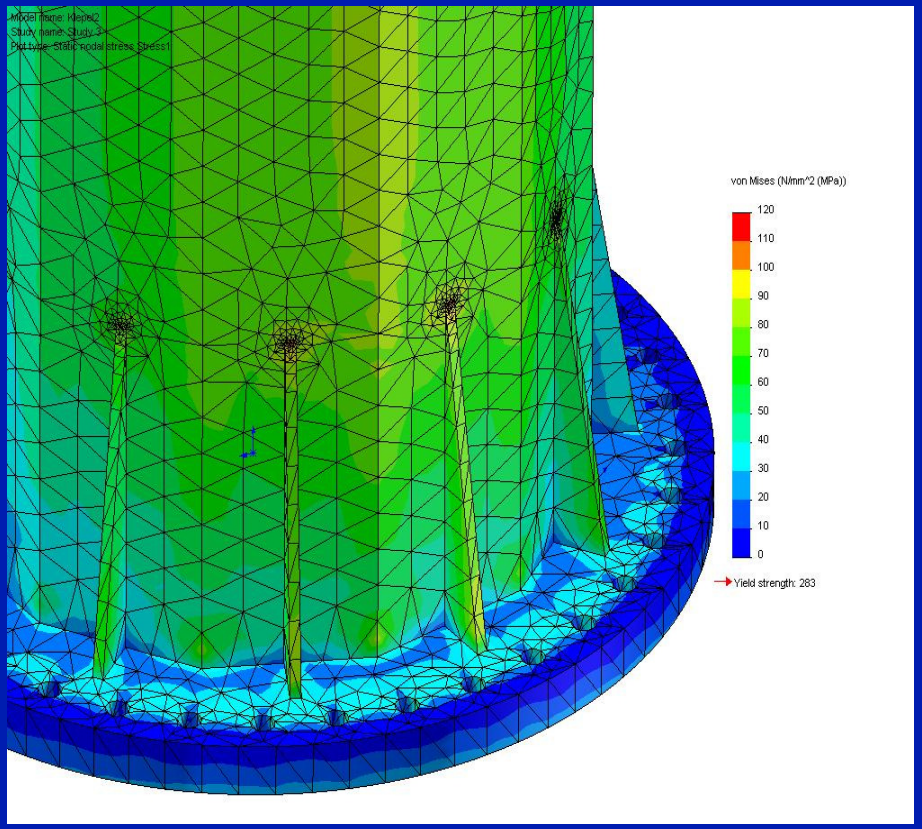
Verifications of

- 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 15018 Teil 1 Seite 25

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

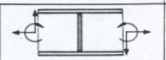
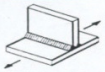
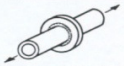
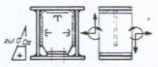
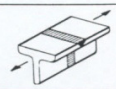
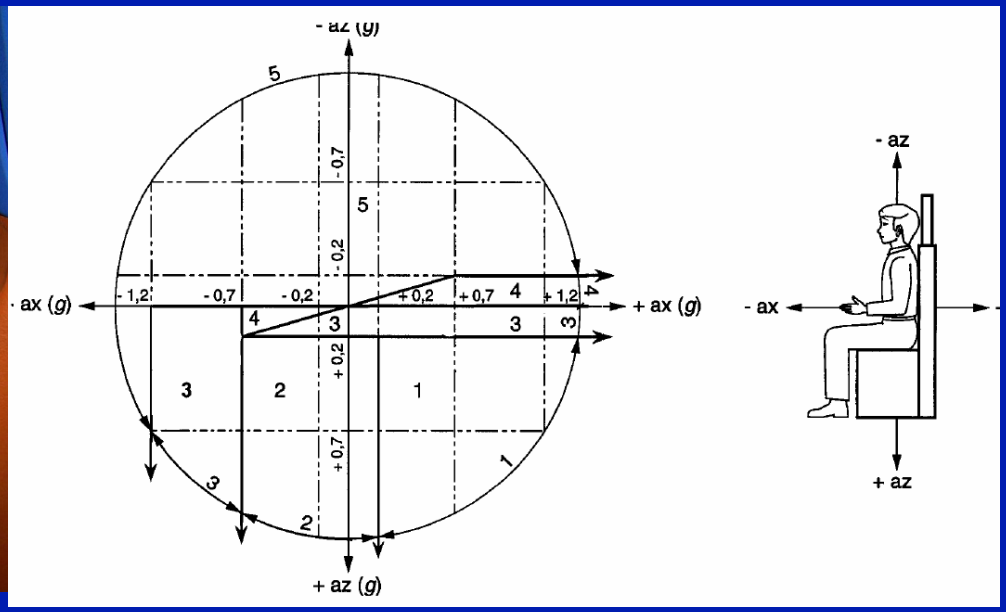
Ordnungs-Nr	Beschreibung und Darstellung		Sinnbild
114	Mit Stumpfnaht-Normalgüte quer verbundene Stegbleche		P oder P 100 P oder P 100
121	Mit Stumpfnaht-Normalgüte längs zur Kraftrichtung verbundene Teile		
123	Mit Kehlnaht-Normalgüte längs zur Kraftrichtung verbundene Teile		
131	Durchlaufendes Teil, an das quer zur Kraftrichtung Teile mit durchlaufender K-Naht mit Doppelkehlnaht-Sondergüte angeschweißt sind		
132	Durchlaufendes Teil, an das quer zur Kraftrichtung Scheiben mit K-Naht mit Doppelkehlnaht-Sondergüte angeschweißt sind		
133	Druckgurte und Stegbleche, an die Querschotte oder Steifen mit abgeschnittenen Ecken mit Doppelkehlnaht-Sondergüte angeschweißt sind. Die Einstufung in den Kerbfall gilt nur für den Bereich der Doppelkehlnähte.		
154	Mit K-Naht mit Doppelkehlnaht-Sondergüte verbundene Steg- und gekrümmte Gurtbleche		

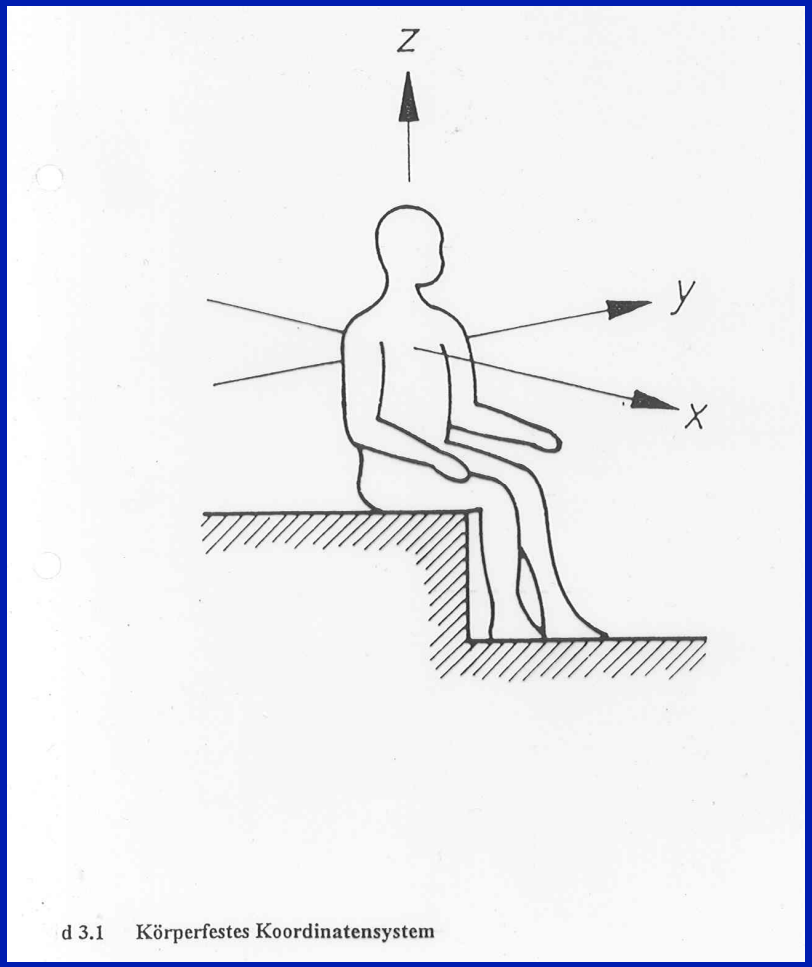
Tabelle 30. **Kerbfall K 2 — mittlere Kerbwirkung**

Ordnungs-Nr	Beschreibung und Darstellung		Sinnbild
211	Mit Stumpfnaht-Sondergüte quer zur Kraftrichtung verbundene Teile aus Formstahl oder Stabstahl, außer Flachstahl		P 100 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.





d 3.1 Körperfestes Koordinatensystem

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

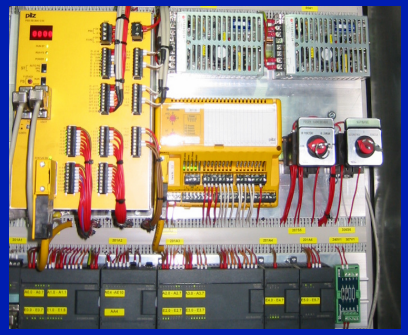
Mechanical Engineering
• Pneumatic
• Hydraulic
• Kinetic and Dynamics
• Machinery Parts
• Drive Units, Gear Boxes
• Cables
• Fatigue Calculation

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

Independent Yearly Inspections

Structural Engineering

Mechanical Engineering



Electrical Engineering

Content

1. **History**
2. Operation Authorization
3. Ride Certification Scheme
4. Risks- Incidents- Accidents

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.

Dangerous Behavior beyond the scope of the standard

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

...

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