

Fall Protection for Engineers

3-day seminar – 22nd to 24th of September 2014 – BG BAU,
Wuppertal / Germany

Venue

BG BAU – Berufsgenossenschaft der Bauwirtschaft
Hofkamp 84
42103 Wuppertal
Germany

The seminar begins on Monday, 22nd of September 2014 at 10:45 a.m.
The seminar is scheduled to end on Wednesday, 24th of September 2014 at 04:00 p.m.

We look forward to working with you in Wuppertal.

Organizers:



In cooperation with:



Fall Protection for Engineers

3-day seminar – 22nd to 24th of September 2014 - BG BAU, Wuppertal / Germany

Introduction

Accidental falls remain the leading cause of injuries and fatalities in many industries. The hazard of falling accompanies almost all jobs on construction sites, shipping or mining. During erection of electricity transmission towers and telecommunication towers, the hazard of falling cannot be eliminated. When constructing typical buildings the fall hazard can and is primarily controlled by the use of guardrails/barriers, but this method is not suitable for towers, oil rigs, wind-mills and many other industries. For example in aircraft hangars, maintenance personnel have to work at heights or walk on the wings of airplanes. Like it or not, we have to resort to personal fall arrest systems (PFAS) and often have to deal with anchor devices – especially complex horizontal lifelines (HLL).



(Photo: Sperian Protection)

The design of PFASs requires knowledge of the dynamics of accelerating and decelerating falling masses. Engineers need to calculate the maximum arrest force (MAF) acting on the FAS user, the total dynamic FAS deflection, the Total Fall Distance and the required clearances. The design of anchor devices should ensure they are capable of withstanding the maximum arrest load (MAL) that is generated in an HLL. Mathematical modeling of flexible horizontal lifeline sag is represented by a catenary equation is needlessly difficult. Parabolic models are almost as accurate and much simpler; however, even this approximation cannot be tackled without iteratively solving the equations.

The MAF should not hurt the fall victim. Its level is limited in EU standards to 6 kN (8 kN in Canada and the USA). Notwithstanding the legal limits, the real injury threshold for a human body subjected to transitory deceleration depends on the direction, the duration and the point of application on the fall casualty's body. The safe MAF limits for the "X" and "Y" directions are lower than the official 6 (8) kN.

Protection against falls from heights is considered by many to be the most complex part of the entire Personal Protective Equipment (PPE) field. In addition to the above described mathematical skills, the FAS designer is faced with an enormous task of selecting components available in a lot of models, makes, types and classes from a large number of suppliers. The differences between various models of equipment that all meet the same standard can be subtle, but can significantly affect the peak impact forces and required clearances. Designers cannot rely on minimum requirements published in standards to accurately describe and compare how equipment certified to these standards will behave. Elimination of the force of gravity is not a viable option, and all joking aside, accidental falls will continue to happen. While we should always seek ways of preventing falls, the removal of the fall hazard is, on very many jobs, either impossible or not economically feasible. We must strive to arrest falls by designing systems that minimize the chance of injuring the worker. This is a noble goal, but very difficult or impossible to achieve with certainty. It is incumbent on design professionals to know and follow best practices that are known to minimize the risks.

Fall Protection for Engineers

3-day seminar – 22nd to 24th of September 2014 - BG BAU, Wuppertal / Germany

General Information

This seminar has previously been presented with great success in Haan in September 2009, in June 2010 and in April 2011 as well as in May 2013 in Frankfurt. It would be of special interest to the construction industry, architects, anyone who designs or assembles components into complete fall protection systems, safety personnel in every industry where fall hazards exist, production managers and supervisors responsible for workers' safety, fall protection equipment manufacturers, government safety specialists, electric and telecommunication utility safety specialists, transportation safety personnel, safety trainers, test engineers, standards writing organizations, mine safety specialists, oil and gas companies, armed forces, professional height rescue teams, alpinists etc.

The seminar will be delivered in English. A formal engineering degree is not a pre-requisite for attendance; however participants are expected to be familiar with basic physics and algebraic mathematics.

The seminar fee is 2.250,00 Euros. It includes meals during the day, a seminar dinner on Tuesday evening and extensive seminar materials.

The Seminar's Objective

The Fall Protection for Engineers seminar explores current state-of-the-art techniques and philosophies for design of personal fall protection systems (PFPS). We emphasize the following considerations that are applicable to all Fall Protection Systems:

1. We should initially respond to all fall hazards attempting to remove the hazard of falling, either by changing the process or by employing equipment, systems or techniques that prevent workers from being at or reaching locations where falls can occur,
2. When it is not feasible to prevent falls, Fall Arrest Systems must be used to reduce fall accident frequency and severity, by meeting as many of the following objectives as possible:
 - The systems must comply with or exceed existing regulations and standards,
 - The Residual Risks in FAS should be minimized,
 - The Fall Protection Engineer should employ the modern tools available to FAS designers and be knowledgeable about state-of-the-art technologies,
 - The systems must be user-friendly,
 - They cannot be overly expensive to implement,
 - They cannot adversely affect productivity,
 - Their net benefit should include cost savings for the employers.

Fall Protection for Engineers

3-day seminar – 22nd to 24th of September 2014 - BG BAU, Wuppertal / Germany

The Speakers

The BG BAU and partners have, in the spirit of international cooperation, invited two experts from Canada to share with their European colleagues, the Canadian experience in design of fall protection systems. Both Andrew C. Sulowski, P.Eng., and Greg Small, P.Eng. share between them over 55 years of continuous work in fall protection engineering all over the world. They are retained as consultants to fall protection manufacturers and suppliers of engineered systems, to assist with complex problems and develop innovative solutions.

Seminar Material Supplied to All Participants

The seminar materials supplied to all participants include electronic copies of several manuals, books, and videos. Participants also receive a one-year-license to use High Engineering Corp's (Microsoft Excel) spreadsheets to simplify the highly complex calculation of Fall Arrest System forces and clearances (especially in the HLLs).

The knowledge and information offered by all speakers is unique and cannot be obtained from any other source. Today's global economy and optimal protection of our workforce compels us to know and use state-of-the art engineering techniques for fall protection. We are confident that participants will concur that their investment will pay for itself very quickly. Participants will develop a new and very scarce level of expertise to offer their current or future employers.

Fall Protection for Engineers

3-day seminar – 22nd to 24th of September 2014 - BG BAU, Wuppertal / Germany

Programm

DAY 1 Monday, 22nd of September, 2014

- 10:45 a.m. Registration of participants
- 11:15 a.m. **Introduction**
Karl-Heinz Noetel
BG BAU – German Social Accident Insurance Institution for the building trade
Vice President ISSA Construction
Andrew Sulowski
Sulowski Fall Protection Inc. (Toronto, Canada)
- Greg Small*
High Engineering Corp. (Calgary, Canada)
- 11:30 a.m. **Fall Protection Regulations in the European Union and European Standards for Personal Fall Protection Equipment**
- EU Directive Regarding Personal Protective Equipment
- Standards for Components
- Standards for Testing
Wolfgang Schäper/Petra Jackisch
BG BAU - German Social Accident Insurance Institution for the building trade
- 12:15 p.m. Lunch
- 01:15 p.m. **Introduction to Human Body Physiology for Fall Protection Engineers**
- The Effects of the Maximum Arrest Force (Shock Load) and Orthostatic Intolerance (Static Suspension)
- The Limits of Energy Absorbers
- The Post-Fall Rescue Time
Andrew Sulowski
- 03:15 p.m. Coffee Break
- 03:30 p.m. **Typical Fall Protection Equipment**
- Harnesses
- Lanyards
- Vertical Lifelines (VLLs)
- Ladder Systems
- Self Retracting Lanyards (SRLs)
Andrew Sulowski
- 05:00 p.m. **Design Assumptions - Equipment**
Worker; Harnesses; Lanyards; Vertical Lifelines; Ladder Systems; Self Retracting Lanyards
Greg Small
- 06:00 p.m. End

Fall Protection for Engineers

3-day seminar – 22nd to 24th of September 2014 - BG BAU, Wuppertal / Germany

DAY 2 Tuesday, 23rd of September, 2014

- 08:30 a.m. **Calculations of Clearances**
- Free Fall
- Deceleration Distance
- Stretch-Out
- Swing Falls
- Clearance Margin
Greg Small
- 09:15 a.m. **Mathematical Modelling - Personal Energy Absorbers (PEA) and Vertical Lifelines**
- Derivation
- Example Hand Calculations
Greg Small
- 10:30 a.m. Coffee Break
- 10:45 a.m. **Mathematical Modelling - Energy Absorbers and Vertical Lifelines (cont'd)**
- Software Calculations
- Use on Sloping Surfaces
Greg Small
- 12:15 p.m. **Lunch**
- 01:15 p.m. **Selected Industrial and Military Fall Protection Systems**
Various best practices from around the world
Andrew Sulowski
- 03:15 p.m. Coffee Break
- 03:30 p.m. **Mathematical Modelling - Simple Horizontal Lifelines (HLLs)**
- Equations
- Software Calculations
Greg Small
- 05:15 p.m. **Mathematical Modelling - Balance Sag Equation**
- Horizontal Lifelines using Horizontal Lifeline Energy Absorbers (HLLLEAs)
Derivation of Equation
- Hand Calculations
Greg Small
- 06:00 p.m. End
- 07:00 p.m. Seminar Dinner

Fall Protection for Engineers

3-day seminar – 22nd to 24th of September 2014 - BG BAU, Wuppertal / Germany

DAY 3 Wednesday 24th of September, 2014

- 08:30 a.m. **Mathematical Modelling - Horizontal Lifelines with Horizontal Lifeline Energy Absorbers**
- Hand Calculations
- Calculations using Software
Greg Small
- 09:30 a.m. **Software Modelling of Complex Horizontal Lifelines**
- Multiple Spans
- Flexible Anchors
- Thermal Effects
Greg Small
- 10:30 a.m. Coffee Break
- 10:45 a.m. **Assessing Risk in Industrial Fall Accidents and Managing Human Performance**
- Calculation of a New Form of Personalized Risk for First Line Supervisors
Andrew Sulowski
- 12:00 p.m. Lunch
- 01:00 p.m. **Software Modelling of Complex Horizontal Lifelines**
- Hybrid Systems
- Simultaneous vs. Sequential Falls
Greg Small
- 02:30 p.m. **Residual Risks in Fall Arrest Systems**
Andrew Sulowski
- 03:15 p.m. **Discussion, Questions and Answers, Certificates, Closing Remarks**
Greg Small
Andrew Sulowski
Karl-Heinz Noetel
- 04:00 p.m. End

Fall Protection for Engineers

3-day seminar – 22nd to 24th of September 2014 - BG BAU, Wuppertal / Germany

Arrival

Address:

BG BAU – Berufsgenossenschaft der Bauwirtschaft

Hofkamp 84

42103 Wuppertal

Germany

Telephone +49 202 398-5029

Telefax +49 202 398-5343

Arrival by train and bus

From Cologne railway station:

- Take a train
 - ICE (direction "Hamburg-Altona" or "Berlin Ostbahnhof") **or**
 - RE (direction "Münster(Westf) Hbf") **or**
 - RB (direction "Wuppertal Hauptbahnhof")to the station "Wuppertal Hauptbahnhof"
- During rush hours, there are trains about every 20 minutes and less. The journey takes about 30 to 45 minutes.
- Walk through the subway in the direction of the city centre to the pedestrian area/Poststraße until you see the building with a sign "Uhrenhaus Abeler". Here you take the street to the right and cross the "Morianstraße" at the pedestrian light. Then you pass the post office and follow the street "Kipdorf" until the roundabout traffic (Street "Hofkamp"). Find the entrance approx. 50 meters on the right side (walking duration about 10 minutes) (*see also map on the next page*).

From Düsseldorf railway station:

- Take a train
 - S 8 (direction "Hagen") **or**
 - RE or ERB (direction "Dortmund" or "Hamm (Westf)")to the station "Wuppertal Hauptbahnhof"
- During rush hours, there are trains about every 30 minutes and less. The journey takes about 30 minutes.
- Follow the instructions above on how to go from Wuppertal railway station to the venue.

From Düsseldorf airport:

- Take a train
 - S 1 (direction "Solingen") **or**
 - RE or (direction "Düsseldorf Hauptbahnhof" or "Aachen Hbf")to the station "Düsseldorf Hauptbahnhof"
- Follow the instructions above on how to go from Düsseldorf railway station to Wuppertal.

Fall Protection for Engineers

3-day seminar – 22nd to 24th of September 2014 - BG BAU, Wuppertal / Germany

Arrival by car

For those arriving by car please use map below.

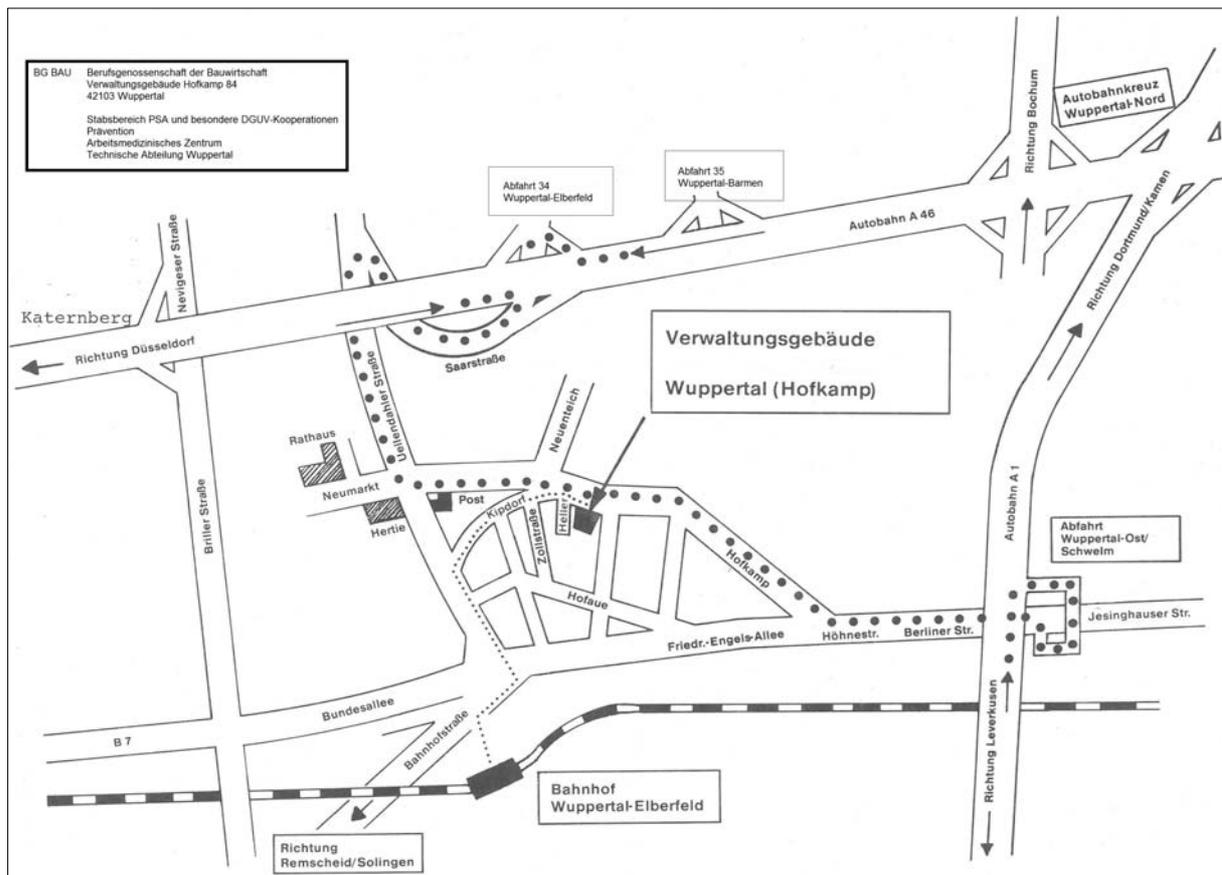
Coming from the highway A 46:

→ leave the motorway on exit number **34** (Wuppertal-Elberfeld) in direction to University

Coming from the highway A 1:

→ take on motorway intersection Wuppertal-Nord the A 46 in direction to Düsseldorf

→ leave the motorway exit number **34** (Wuppertal-Elberfeld) in direction to University



Through the following link <http://www.bgbau.de/die-bg-bau/ansprechpa/anfahrt/wuppertal-amd> you have the possibility to receive a more detailed route description to the BG BAU building in Wuppertal for those arriving by car (unfortunately only available in German).

Info

The meeting place is situated on the **5th floor** of the building.
Please announce yourself to the reception office at the entrance and we will guide you to the meeting room.

Fall Protection for Engineers

3-day seminar – 22nd to 24th of September 2014 - BG BAU, Wuppertal / Germany

Hotel Information

We have made preliminary reservations of rooms at special rates in the following hotel:

InterCityHotel Wuppertal
Döppersberg 50
42103 Wuppertal, Germany
Tel.: +49 202-4306-0
E-Mail: wuppertal@intercityhotel.de
Internet: www.intercityhotel.de

Reservation:

Tel.: +49 202 4306 730
Fax: +49 202 4306 777
E-Mail: reservation@wuppertal.intercityhotel.de

The hotel is in walking distance (about 1 km) from the BG BAU building and easily accessible by foot, by car or by public transport.

From station "Wuppertal Hauptbahnhof"

→The InterCityHotel Wuppertal is located only 100 meters away from Wuppertal main station.

One night in a single room costs 97 € (breakfast included).

Please make your own reservation – at your own costs – directly with the hotel before **7th of September 2014**, mentioning the keyword **Fall Protection**.

The seminar-dinner will take place in a restaurant close to the hotel and the seminar building.

If you have any questions or would prefer another hotel, please do not hesitate to contact us.