

# NATIONAL URBAN SEARCH & RESCUE RESPONSE SYSTEM

## ADVISORY ORGANIZATION UPDATES



Federal Emergency Management Agency  
Department of Homeland Security



# German Picket Testing

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## ***Ground Anchors - Experimental Investigations for Bearing and Deformation Behavior***

- Hessian Fire Brigade School and the Institute of Geotechnical Research Center at the Darmstadt Technical University
- Questioned the Fire Service Regulations (FwDV) which specifies the regulations for fire departments in Germany.



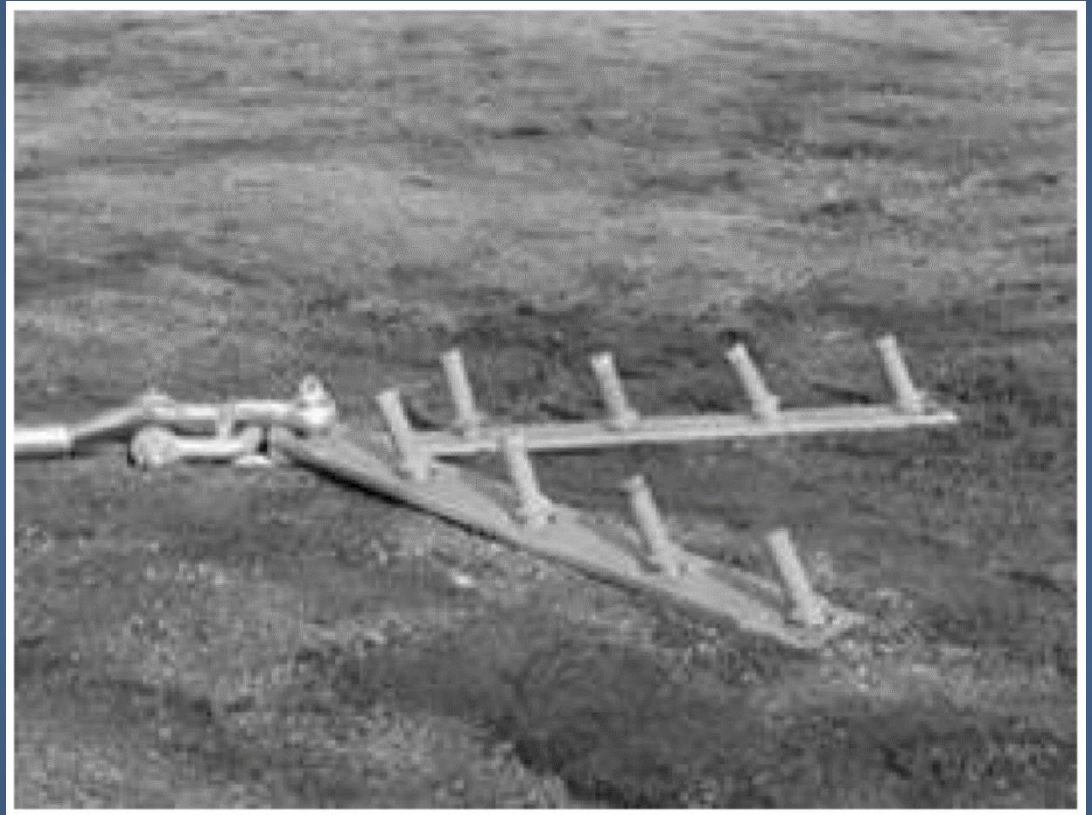
# German Picket Testing

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**FwDV - 1**

**Section 12.3**

**September 2006**



**National US&R Response System**

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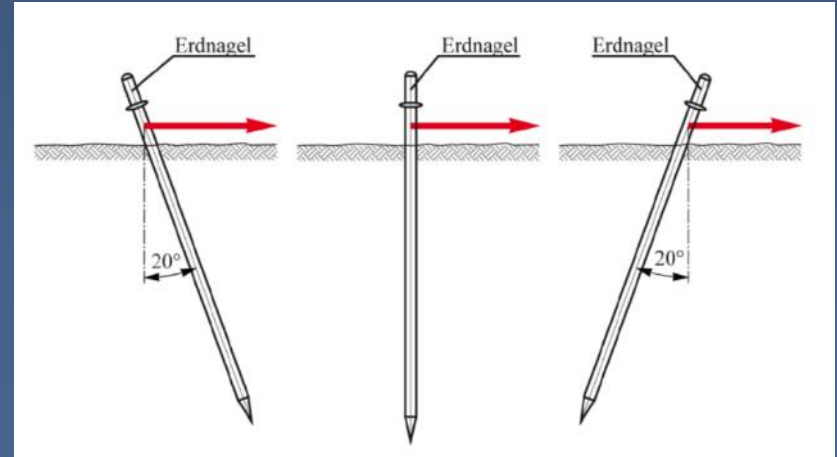
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# German Picket Testing

**24 load tests**

**Sand and Clay**



**Loading by Winch on  
Fire Truck with Load  
Cell**



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# German Picket Testing

## 12-Picket Assembly – Forward Inclination - Sand



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# German Picket Testing

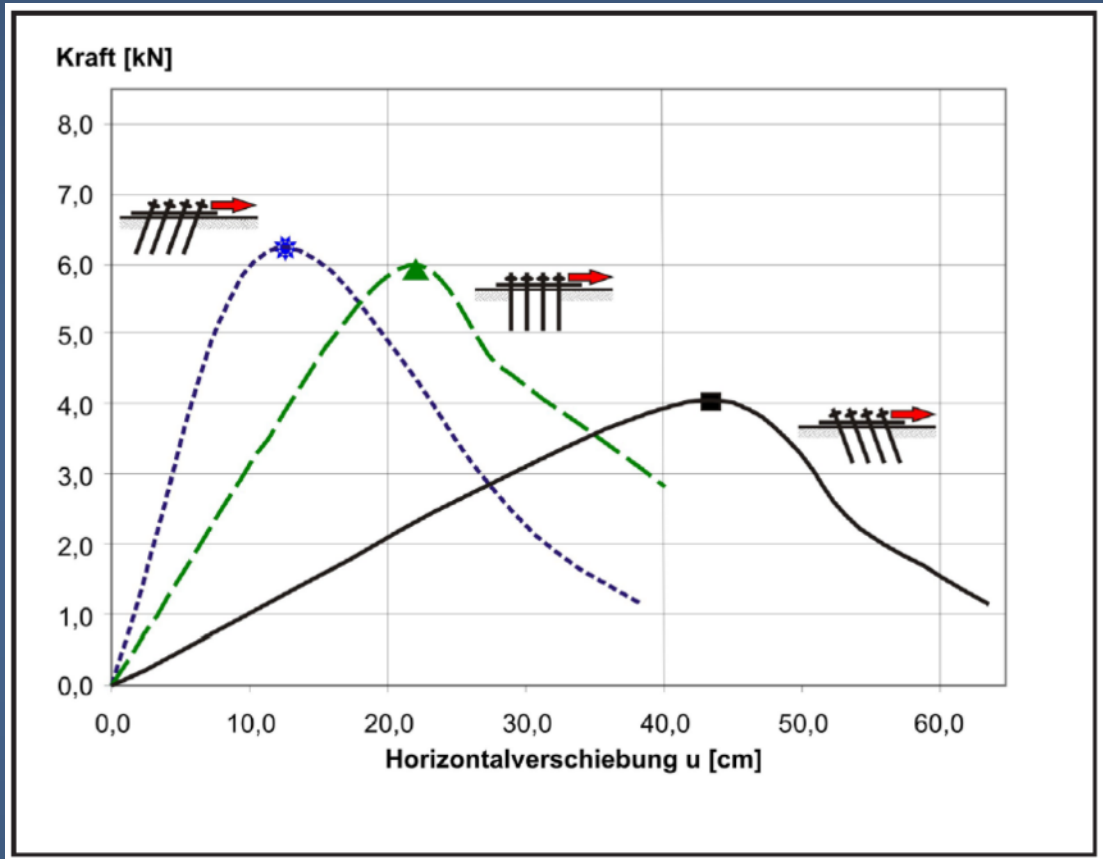
## 12-Picket Assembly

Sand

1,400 lbs

1,320 lbs

920 lbs



# German Picket Testing

## 12-Picket Assembly

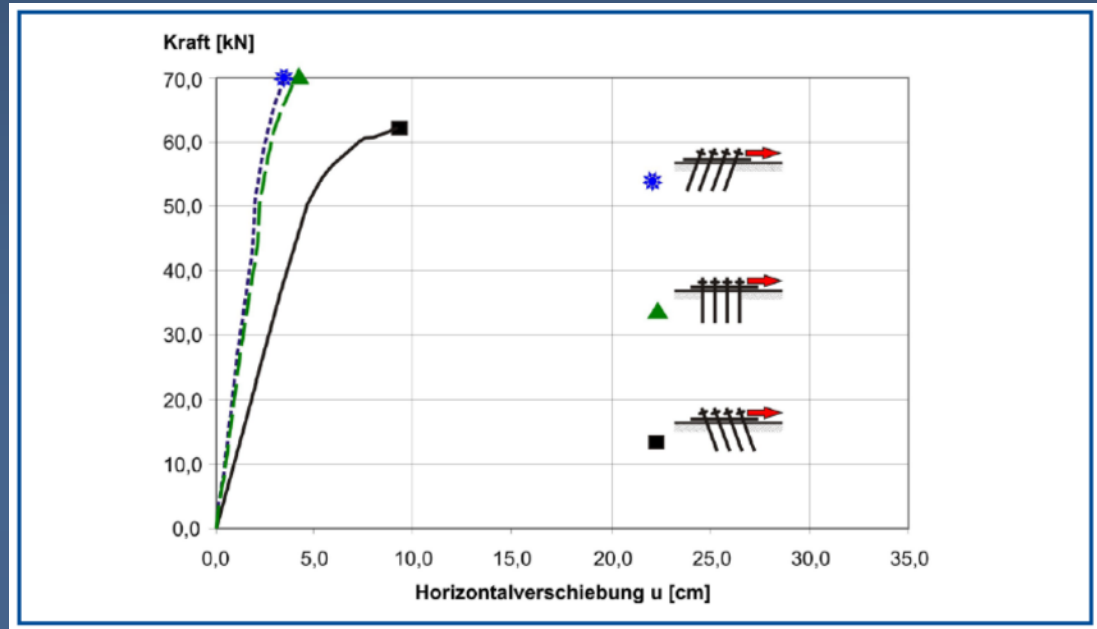
Clay

Exceeded Load  
Capacity of Test  
Setup (15,700 lbs  
max)

15,700 lbs

15,700 lbs

13,700 lbs



Note – deformation similar for vertical and leaning forward pickets

# German Picket Testing

## 6-Picket Assembly

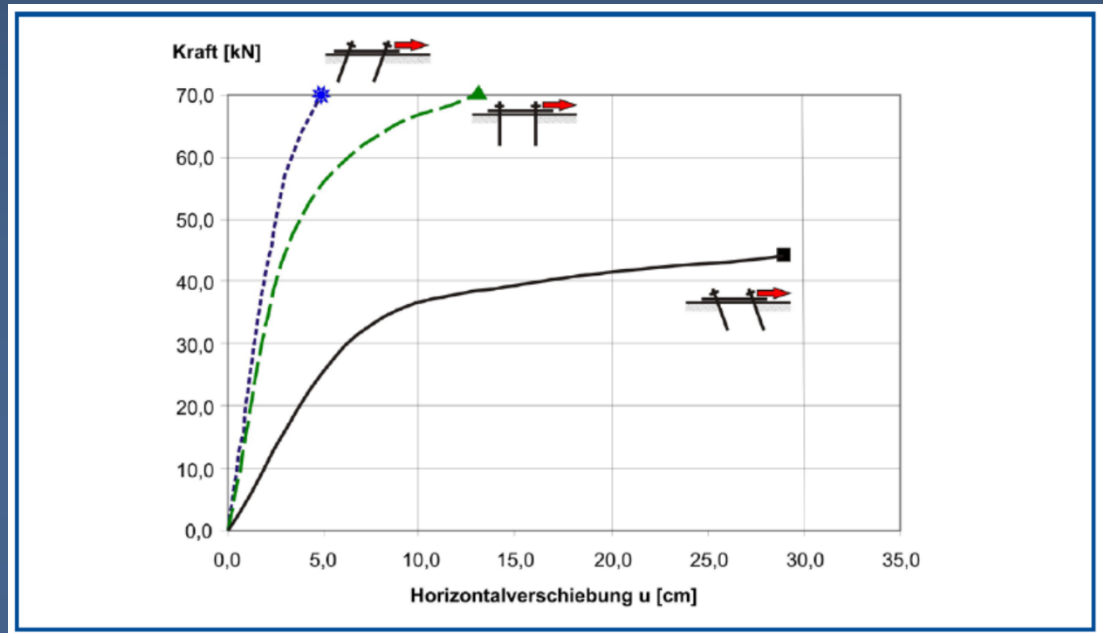
Clay

Exceeded Load  
Capacity of Test  
Setup (15,700 lbs  
max)

15,700 lbs

15,700 lbs

9,900 lbs



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# German Picket Testing

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## Conclusions:

- **Pickets have the most favorable bearing and deformation behavior when inclined at 20 ° to the vertical in the loading direction.**
- **The bearing and deformation behavior of a picket is strongly dependent on the type of soil.**



# FEMA US&R Picket Testing

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Structures Specialist Advanced  
Training Course (StS2)

Menlo Park, CA (CA-TF3)

May 2019

6 Load Tests using  
48-inch long, 1-inch  
dia. Pickets



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# FEMA US&R Picket Testing

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## Measured:

- Picket Angle
- Head Displacement
- Load

**Poor Record Keeping!**



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# FEMA US&R Picket Testing



## Initial Position

Leaning Back

Vertical

Leaning Forward

## Peak Load

1,350 lbs

1,690 lbs

2,400 lbs

2,130 lbs

3,480 lbs

2,410 lbs



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# FEMA US&R Picket Testing

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## Further Testing:

- Similar tests with better recordkeeping.
- Attachment height relative to ground.
- Angle of applied force.
- Double pickets.
- Soil types (limited by Menlo Park site).

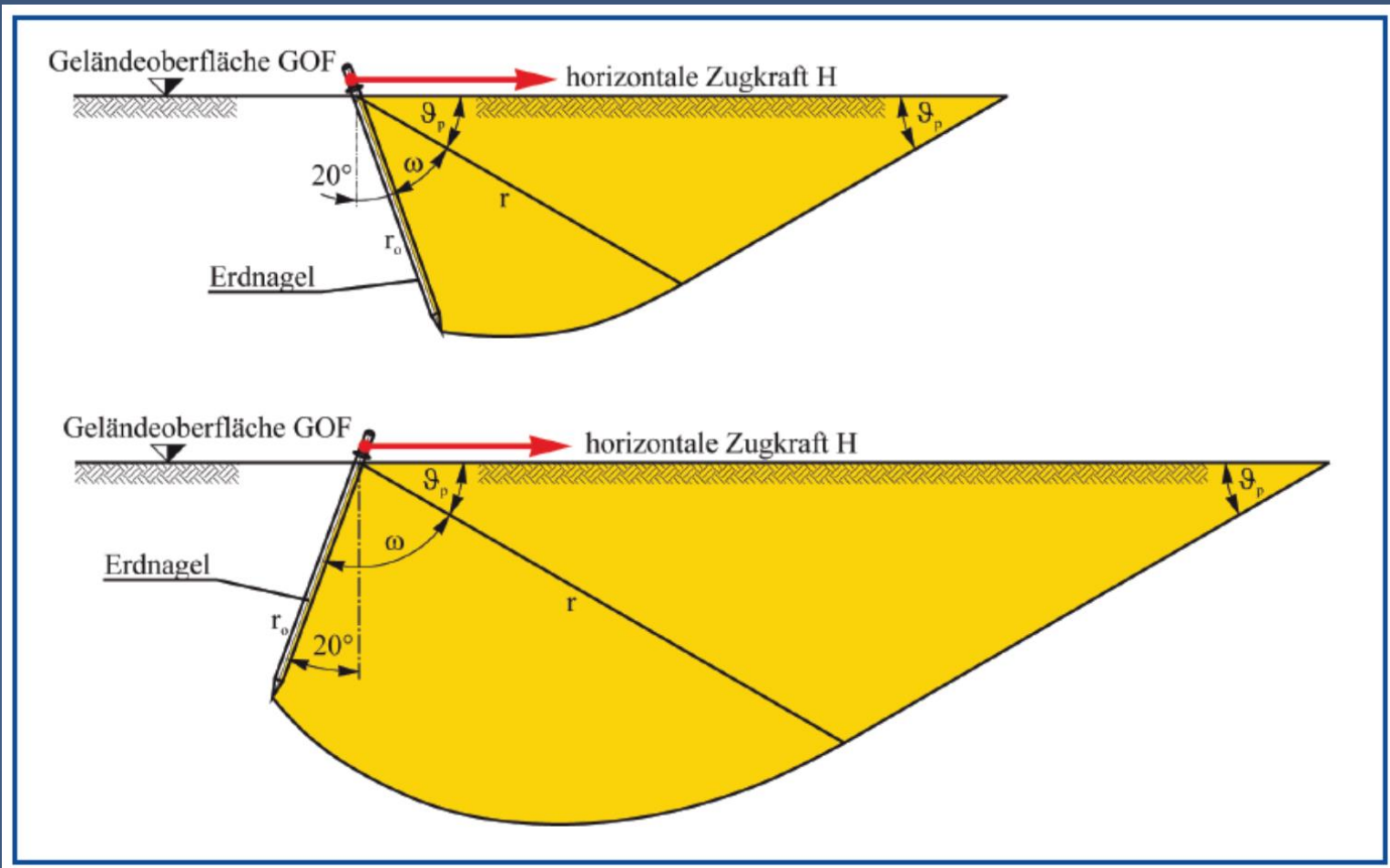


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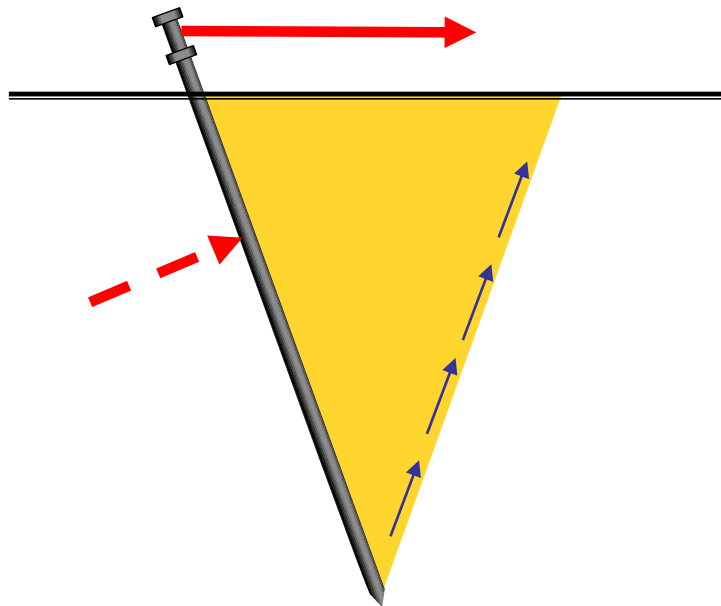
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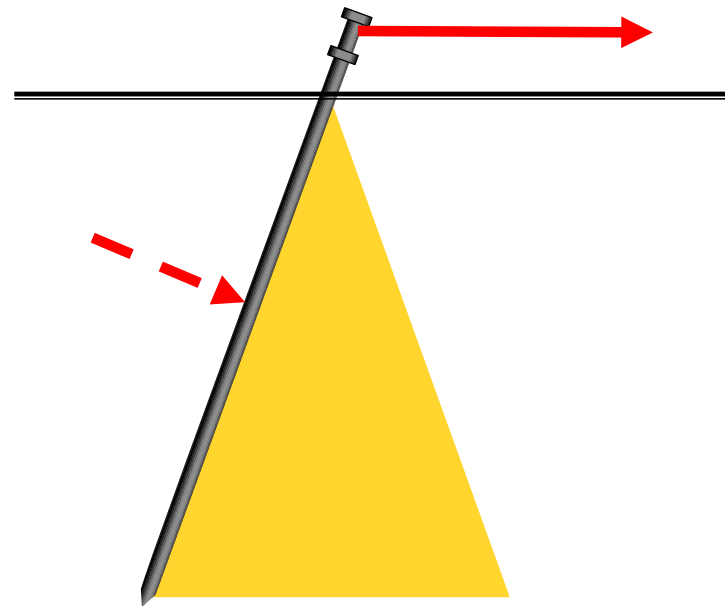
# Picket Behavior – German Explanation



# Picket Behavior – PBK



Leaning Back



Leaning Forward