

# INVESTIGATION INTO PERFORMANCE CAPABILITY OF HYDRO PRE-STRESSED TENDON SUPPORT

Naomi Ayres

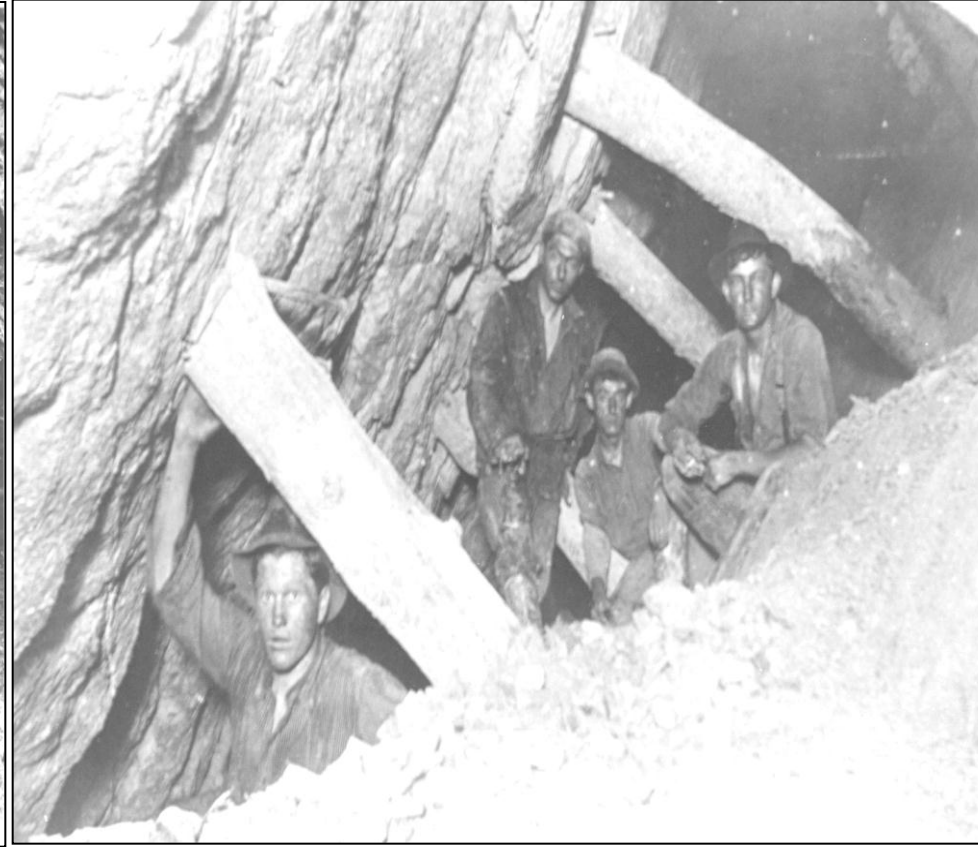


# Disclaimer

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- The material in this presentation is for information purposes only.
- The material has been prepared for ease of communication, rather than technical correctness, and should not be considered in isolation or as the final word on the subject.
- The photographs shown may show conditions and activities that are not necessarily accepted practice, and their source will remain anonymous.
- The opinions are those of the author, and may not necessarily represent the official viewpoint of Impala Platinum Limited.

# Support Systems



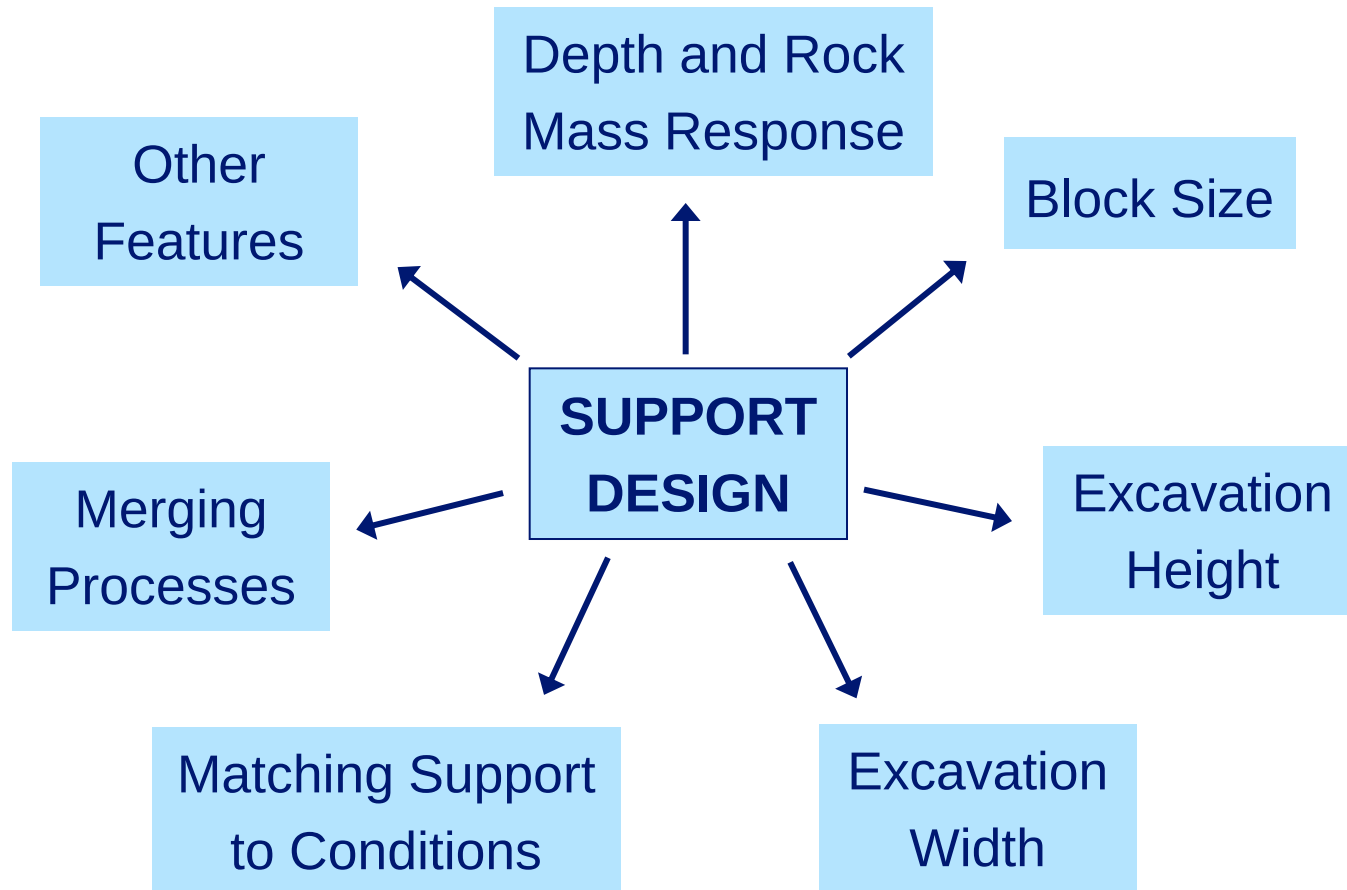
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# Support Systems

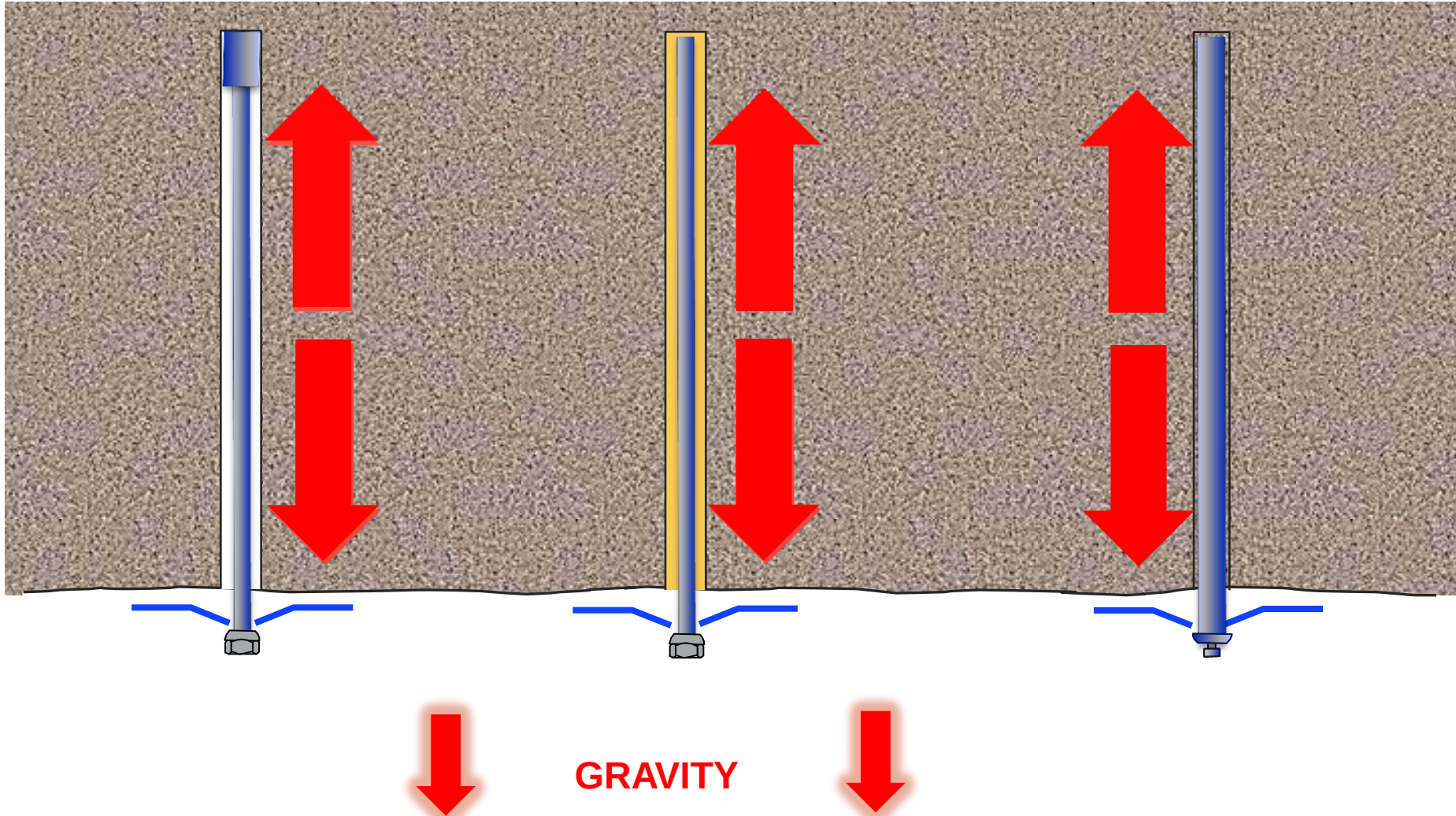


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# Typical Support Design Process

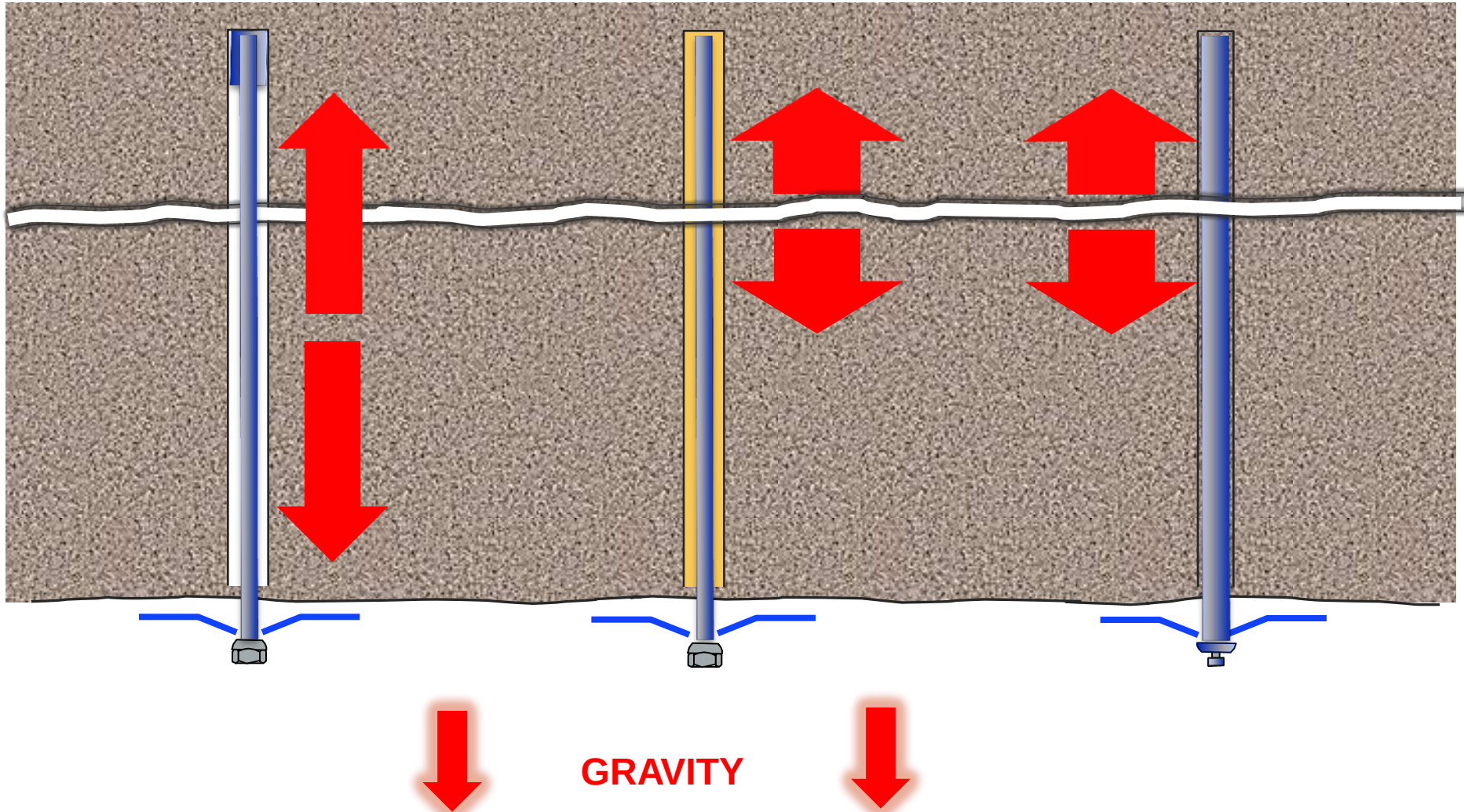


# Tensile Loading



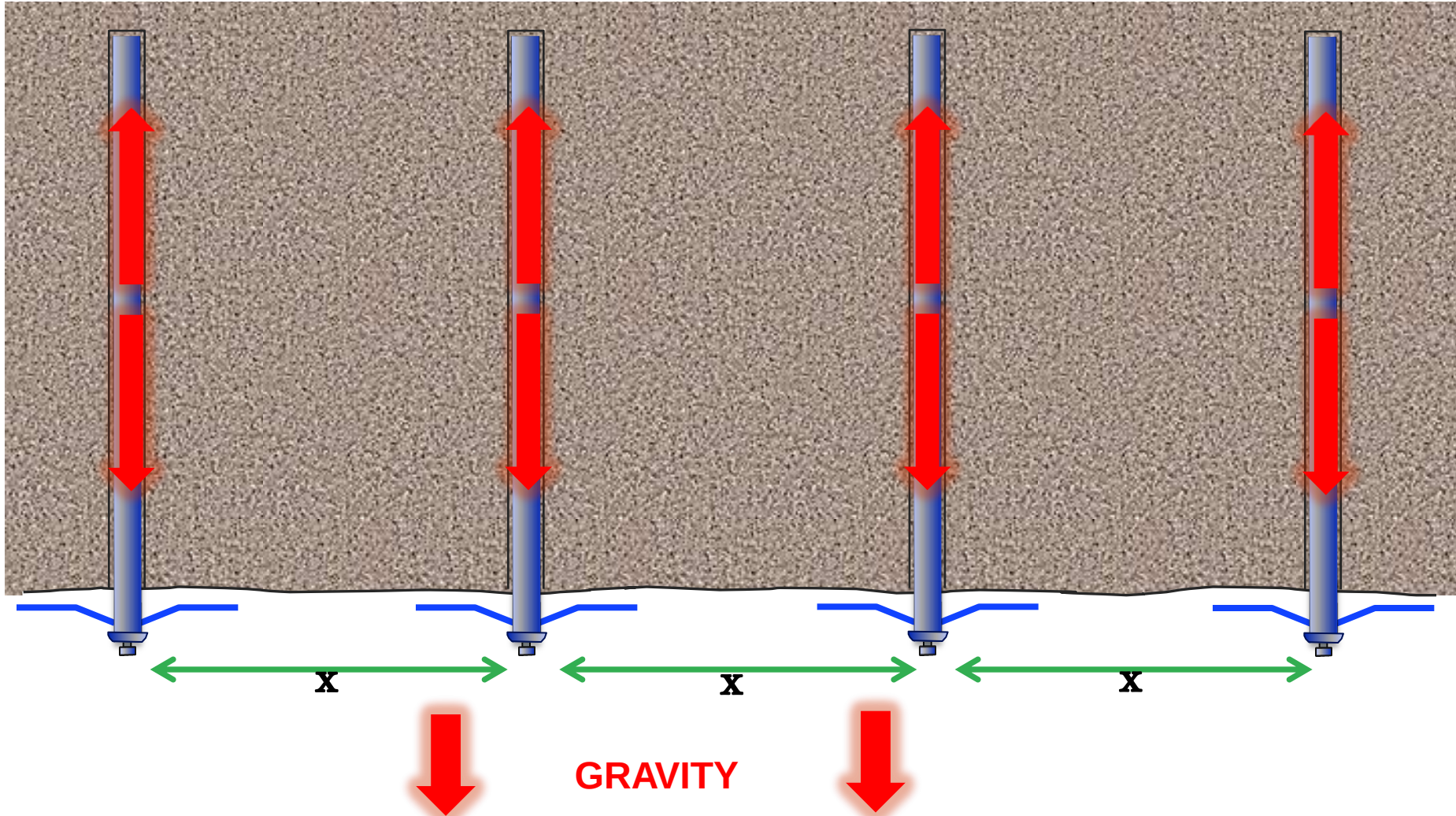
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# Tensile Loading



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# Support System Design



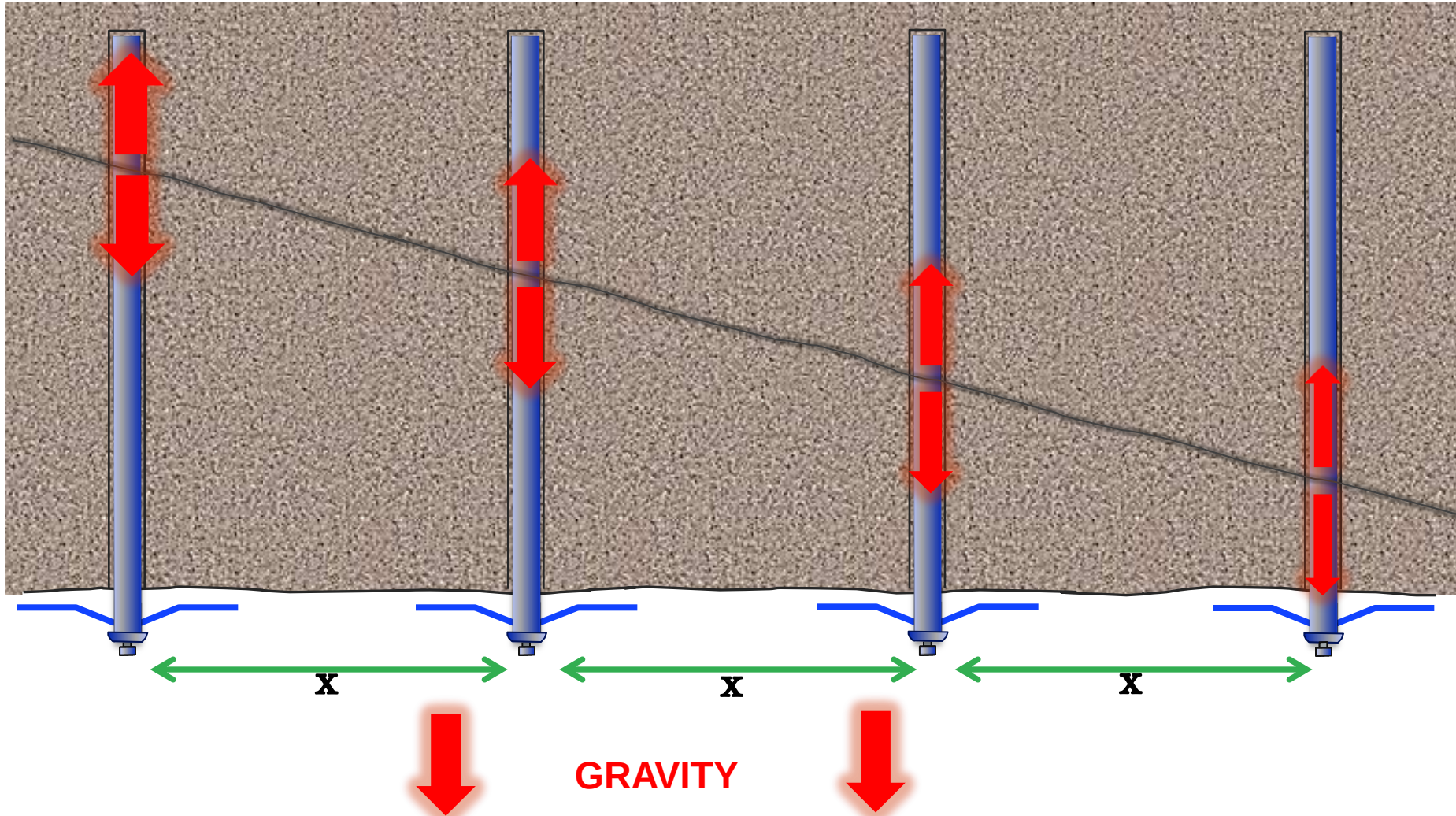
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# Effective??



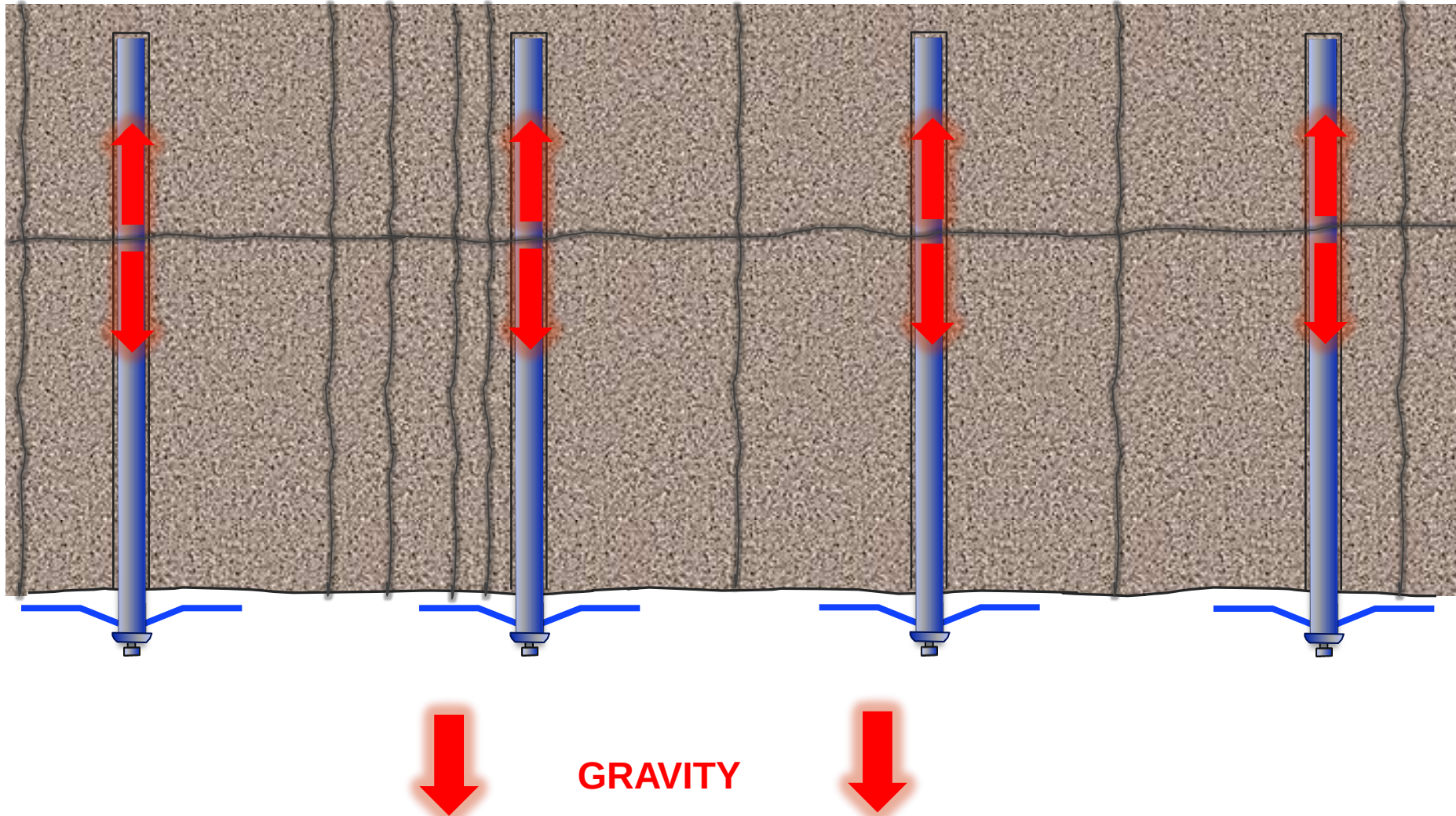
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# Geological Influence



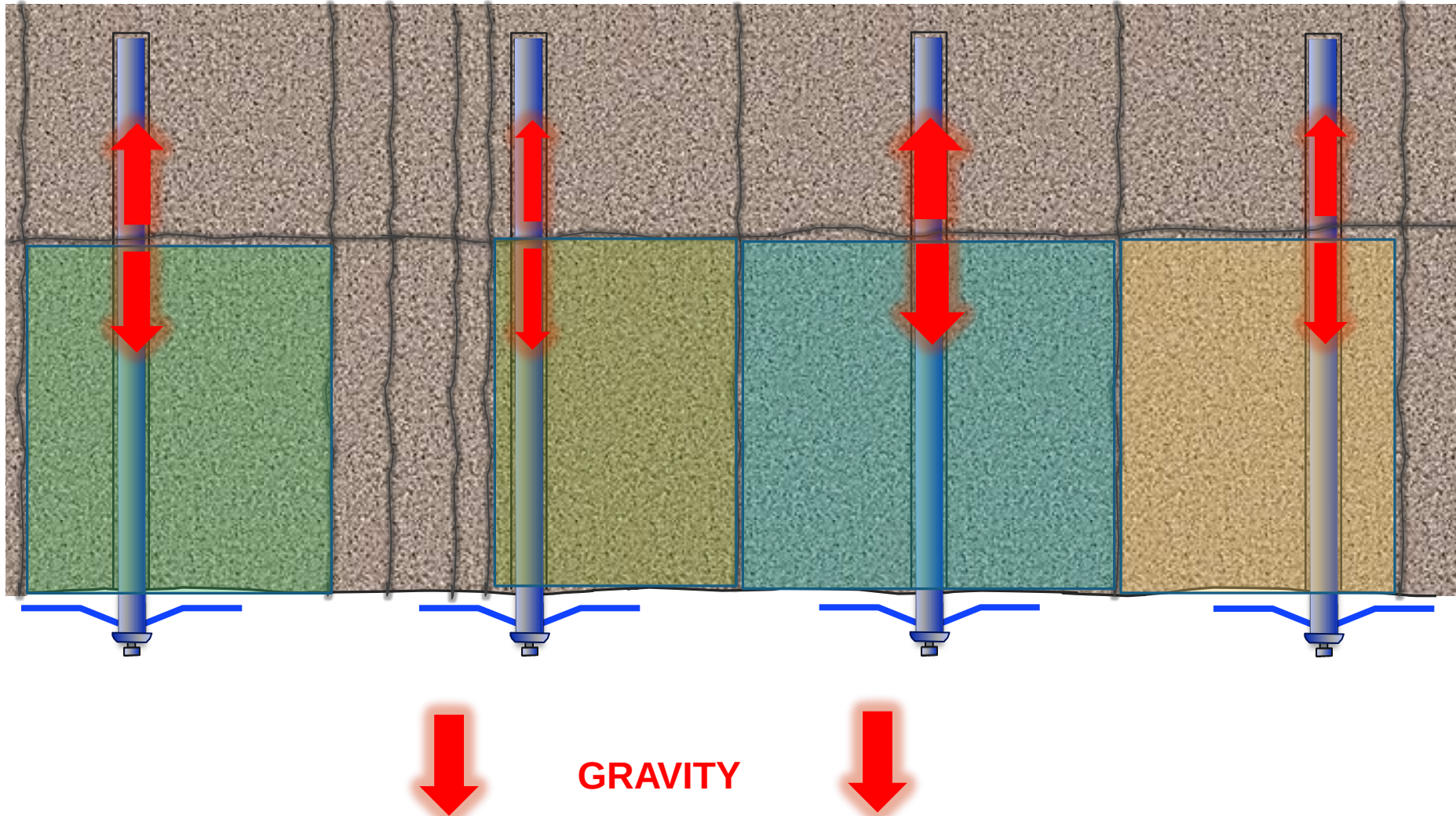
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# Geological Influence



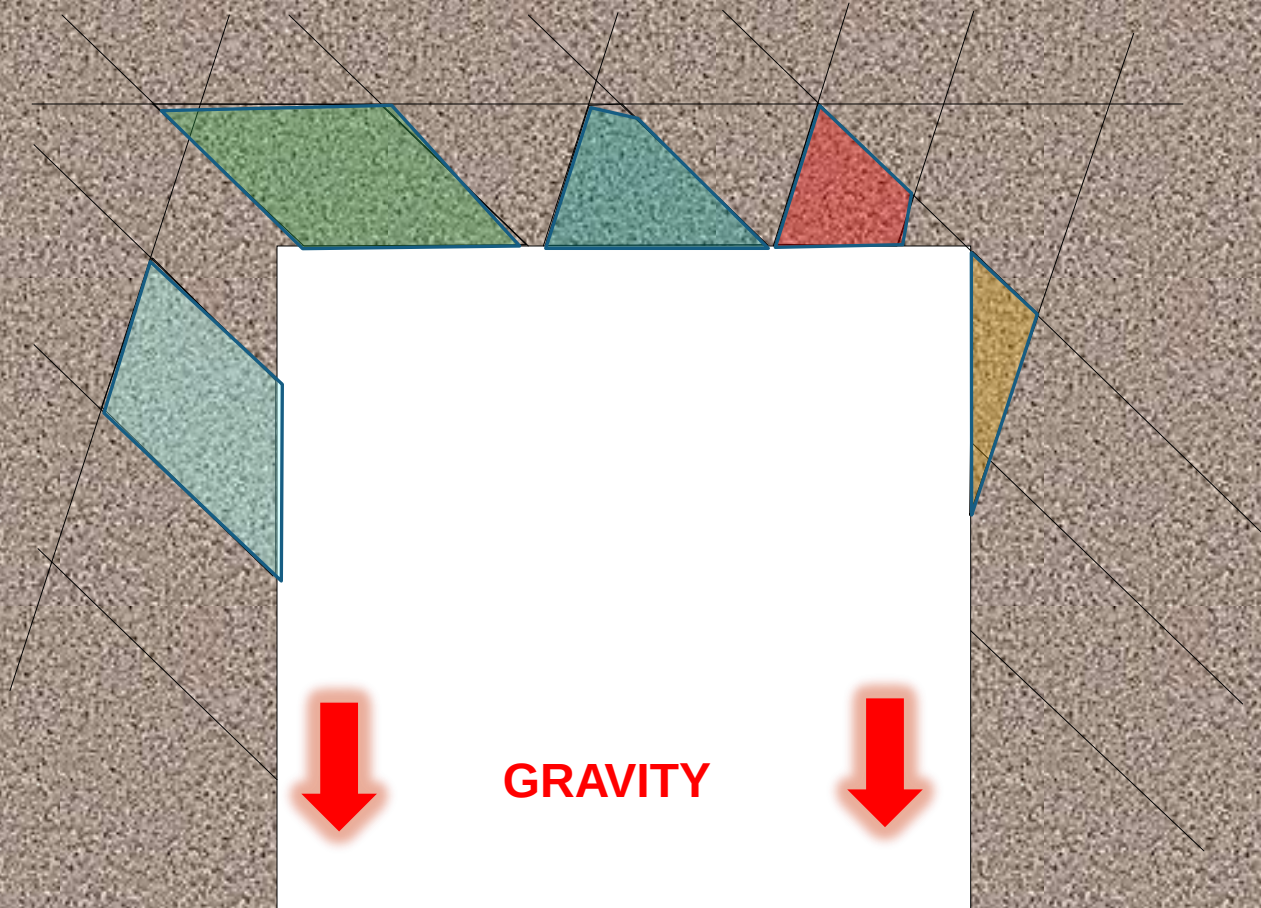
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# Geological Influence



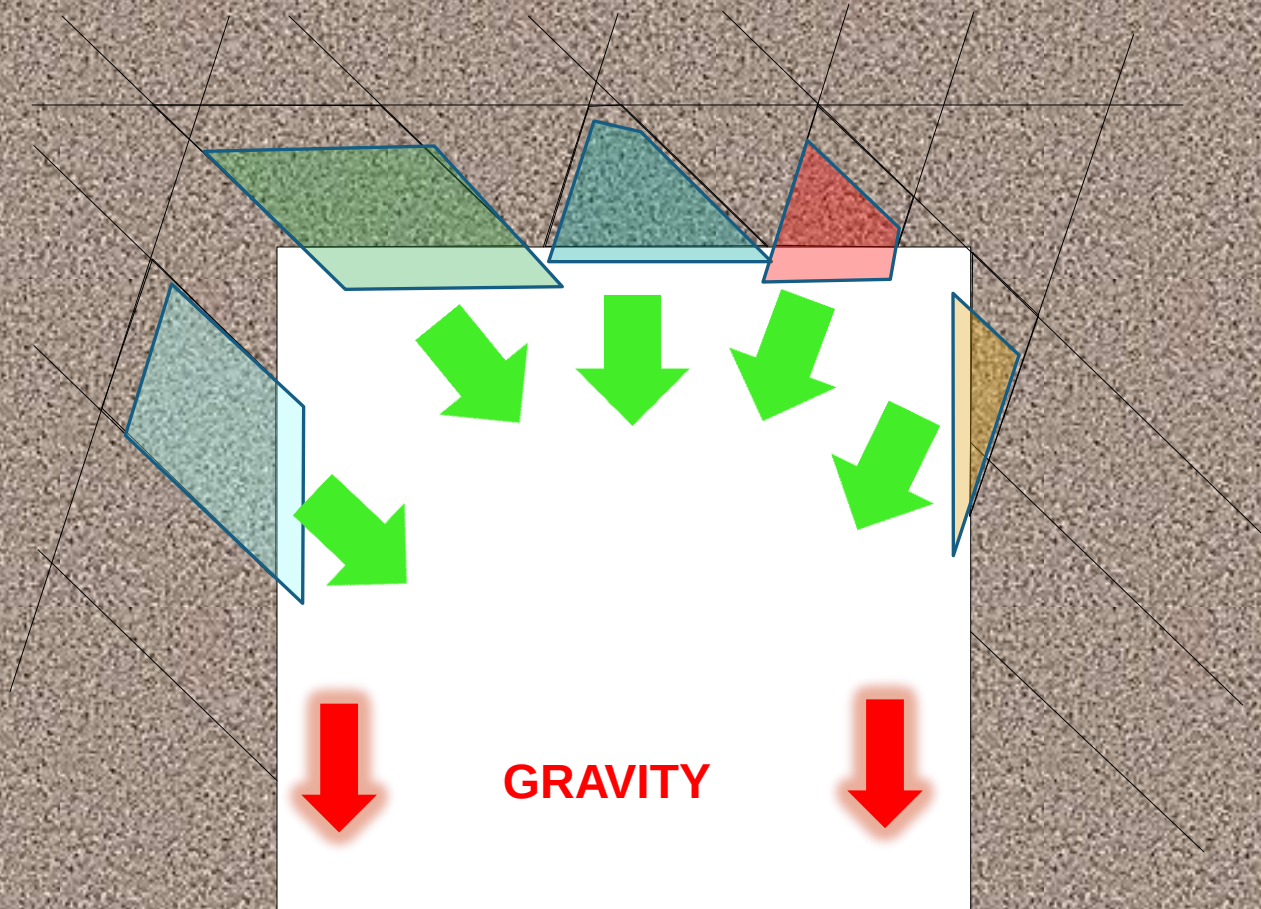
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# Wedge Creation



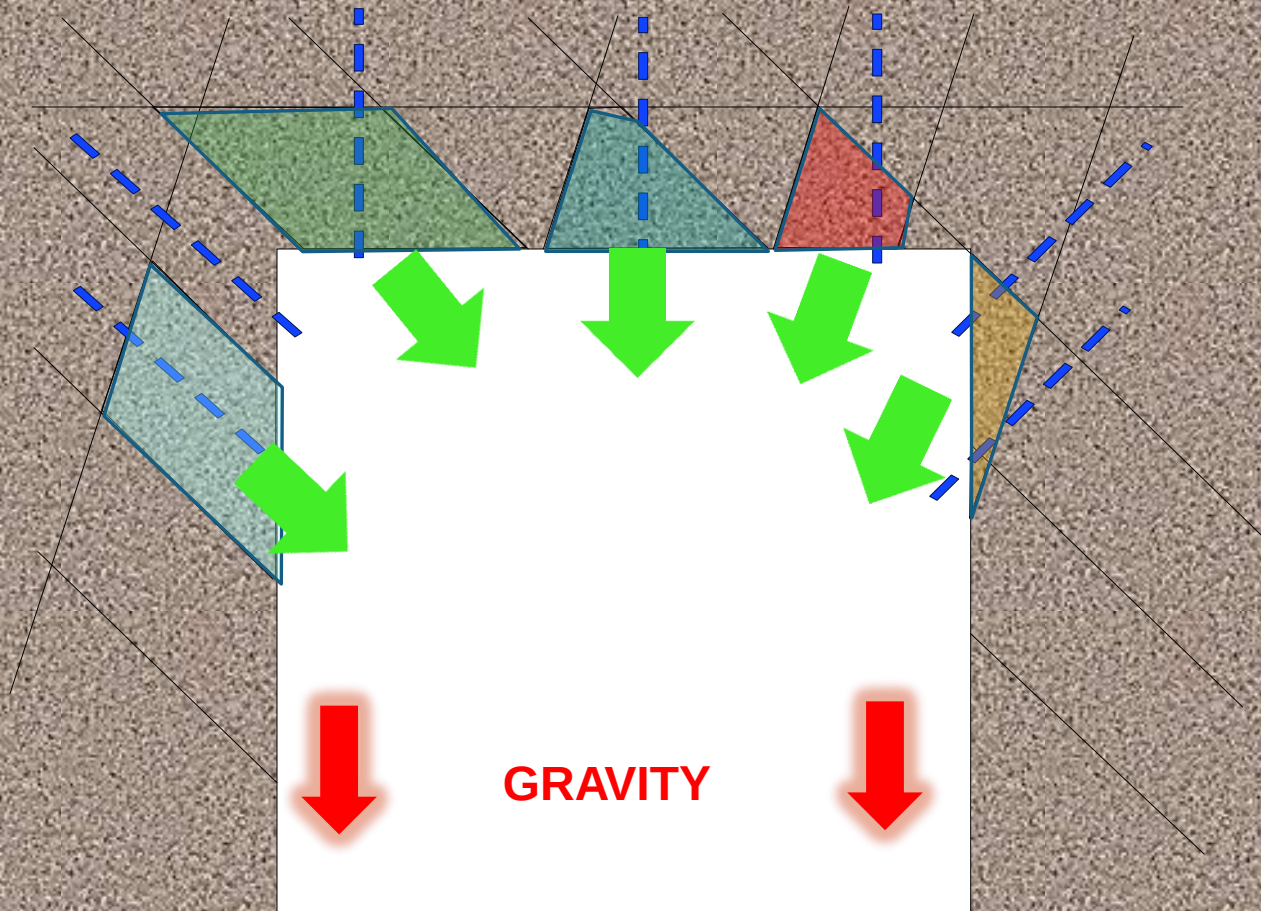
Cross section of a horizontal excavation

# Resultant Loading



Cross section of a horizontal excavation

# Resultant Loading



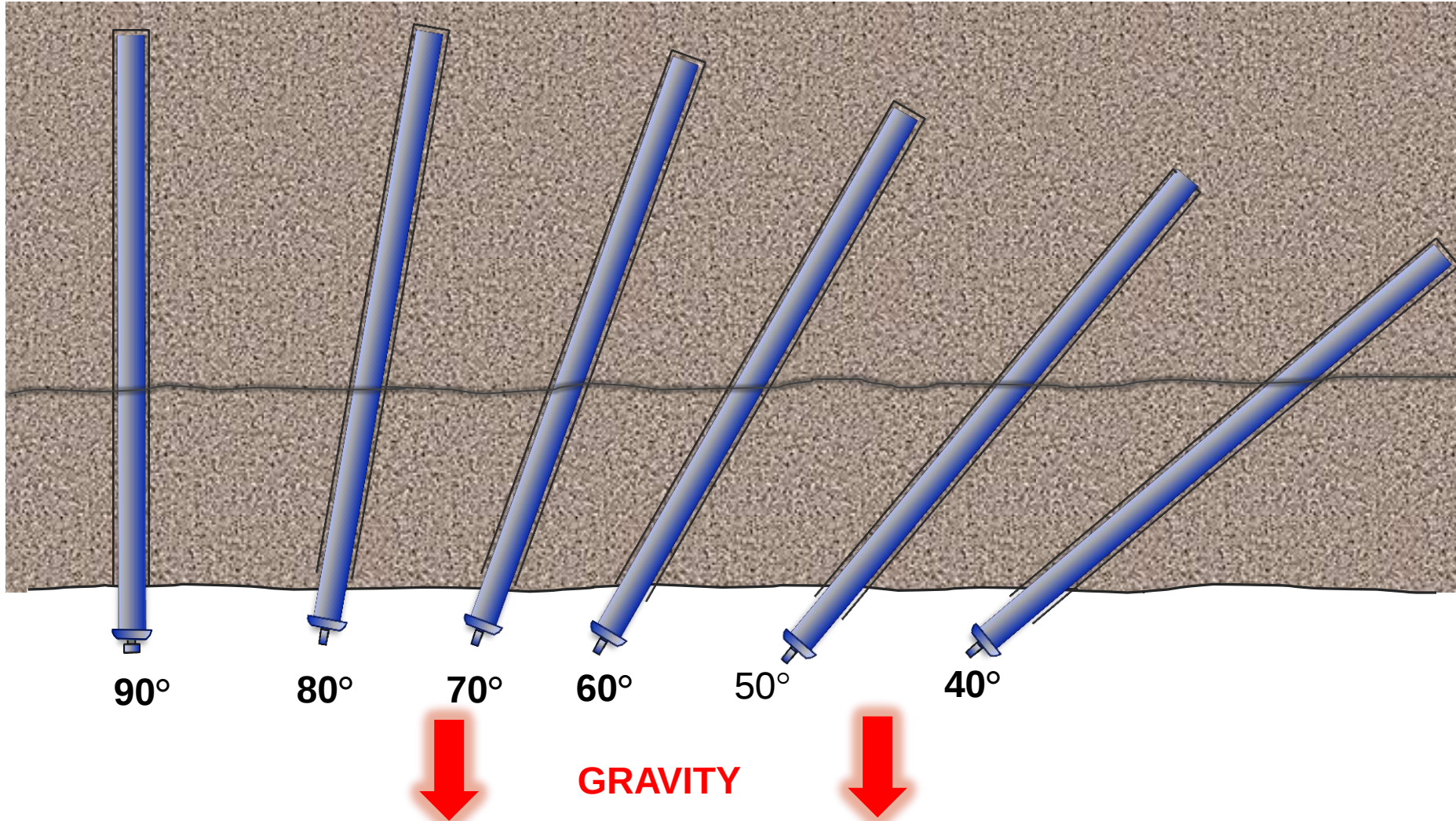
Cross section of a horizontal excavation

# Wedges Created in Hanging Wall



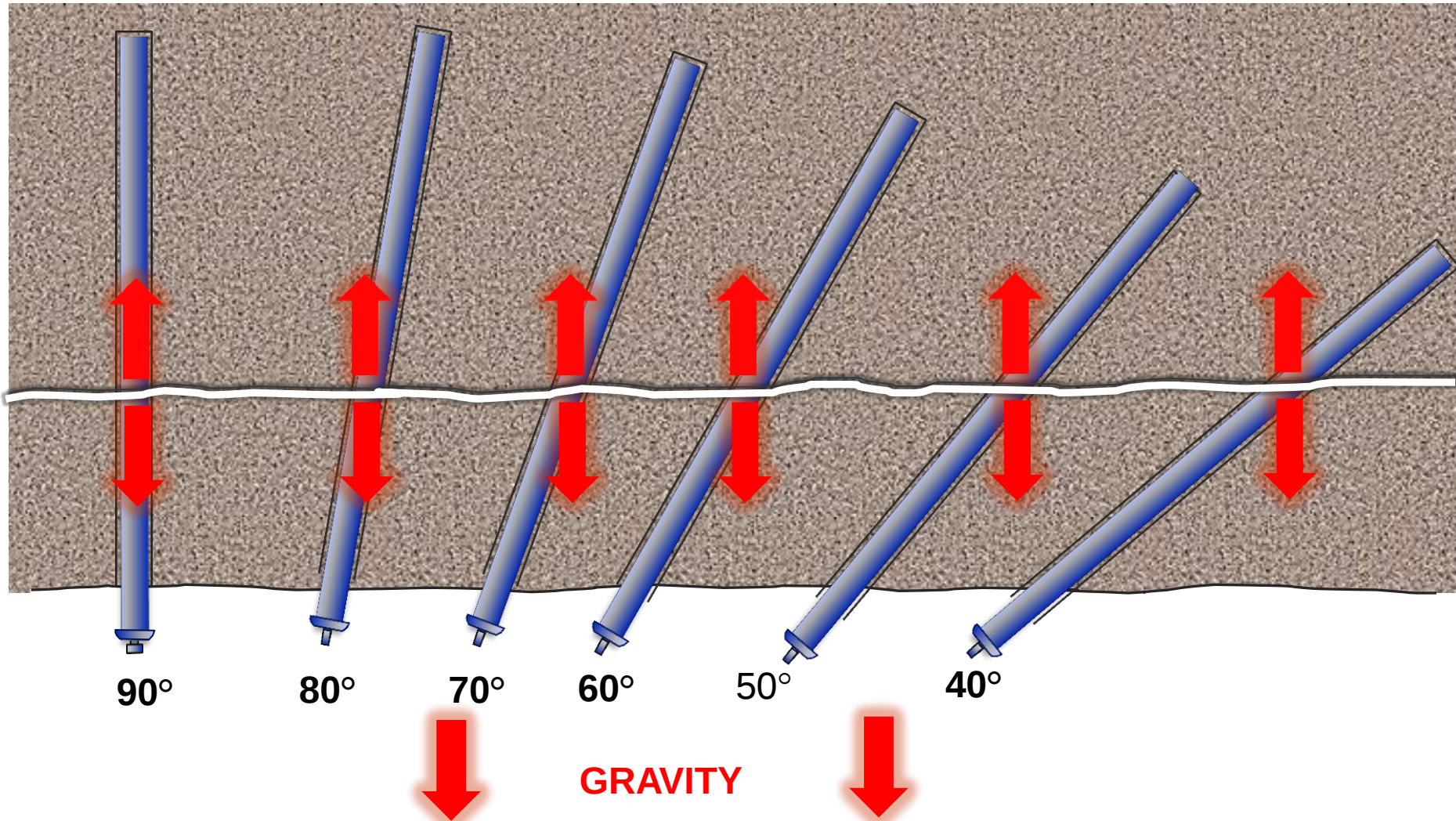
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# Installation Angle



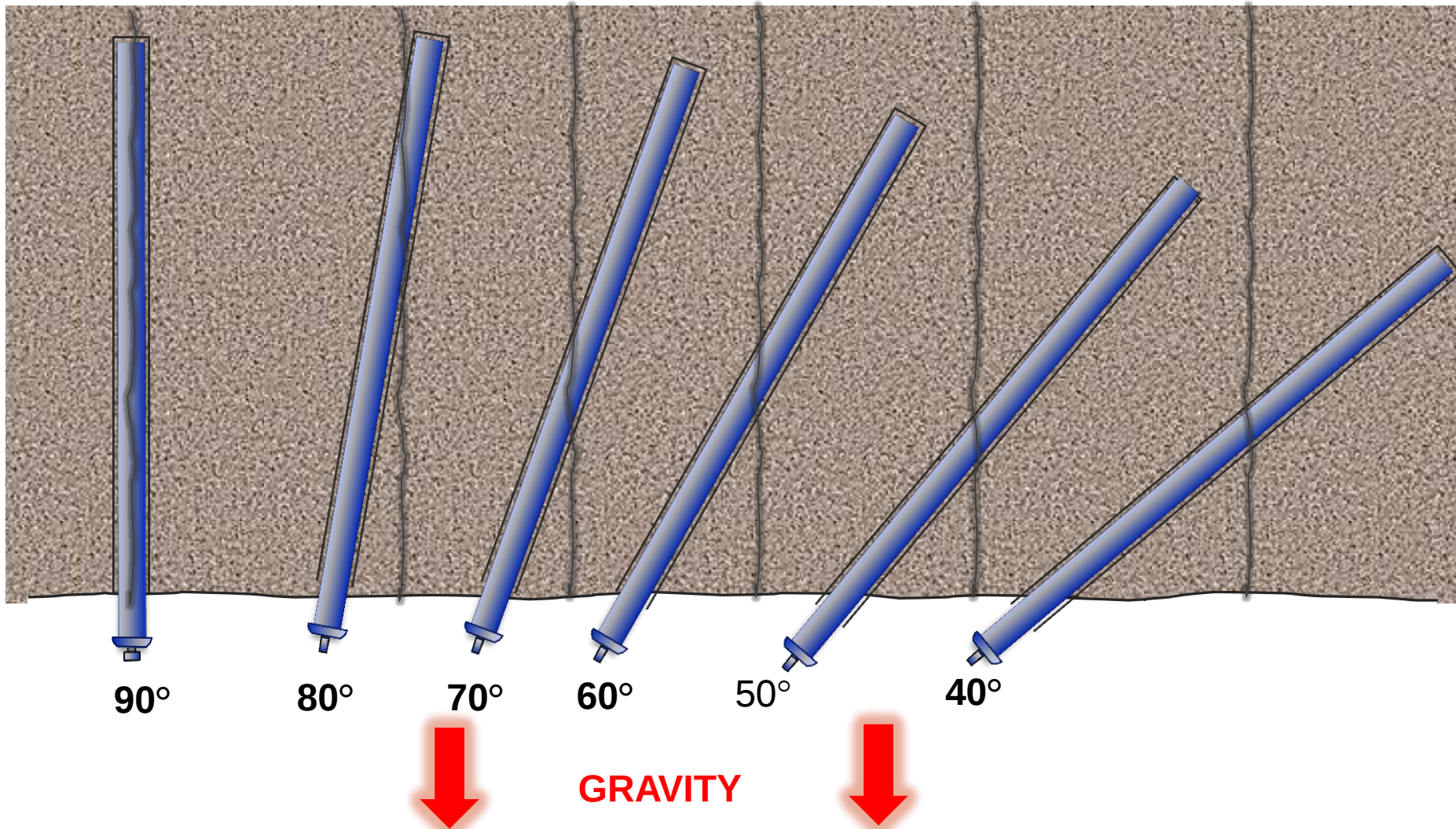
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# Installation Angle



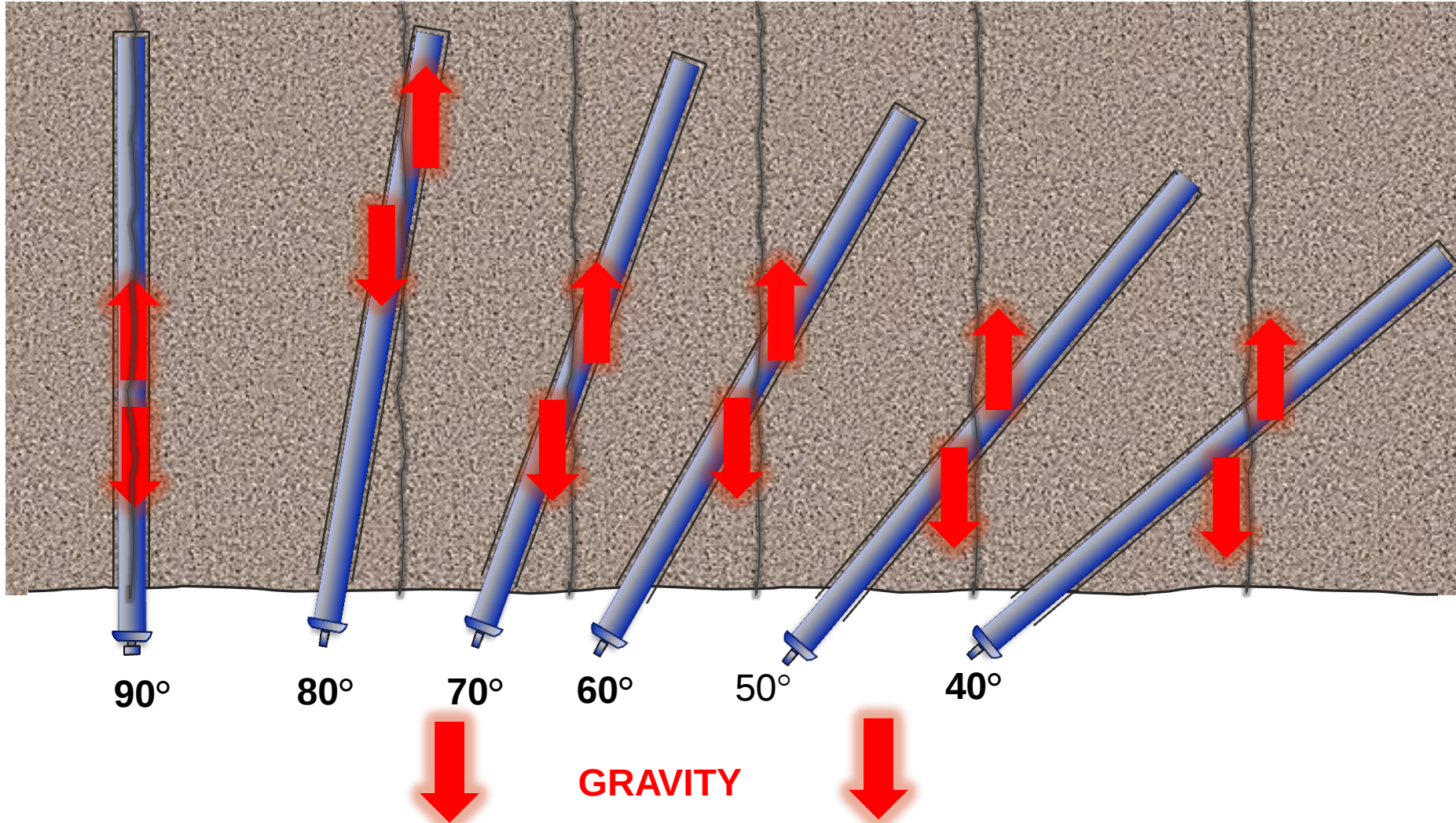
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# Installation Angle



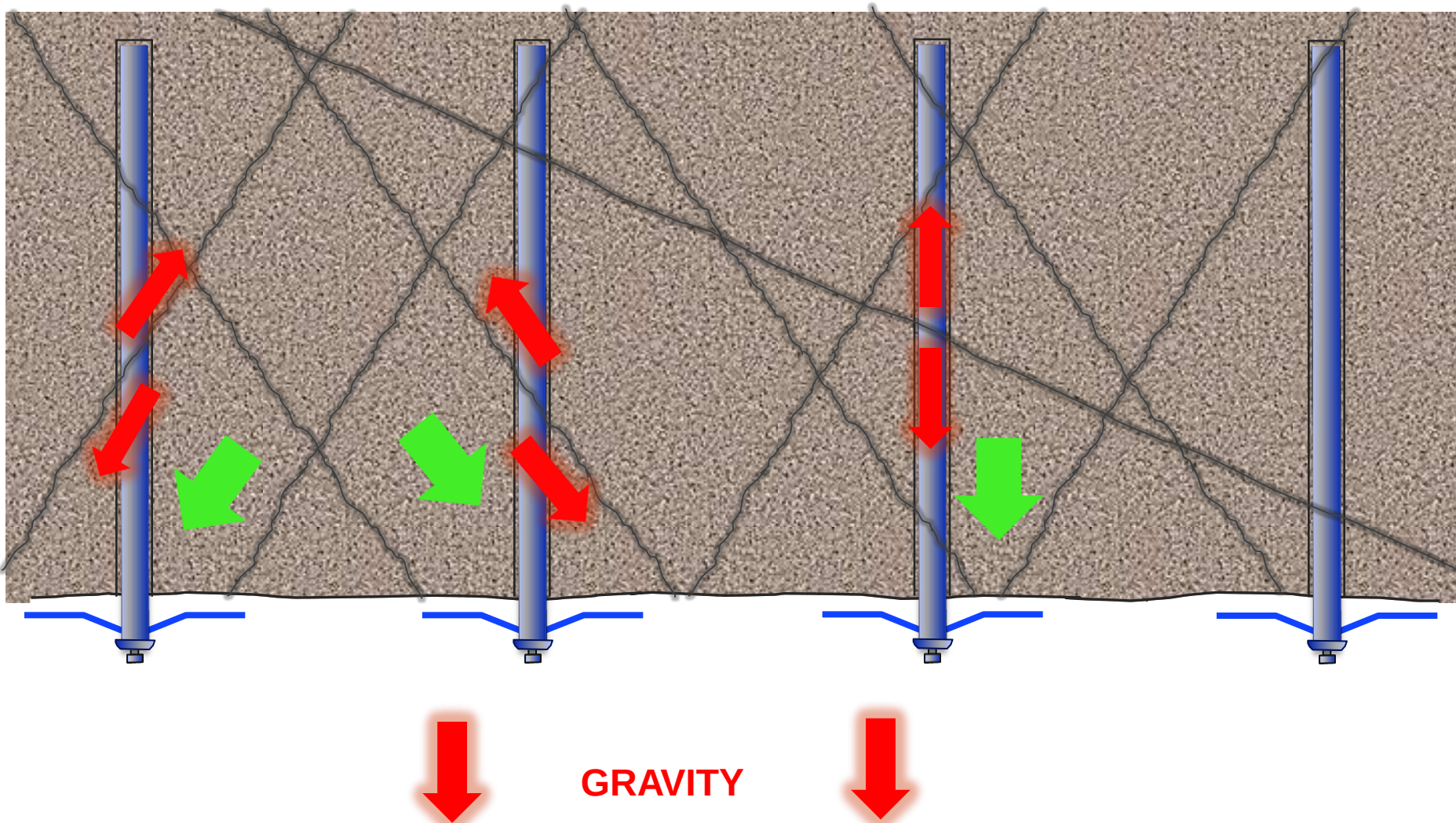
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# Installation Angle



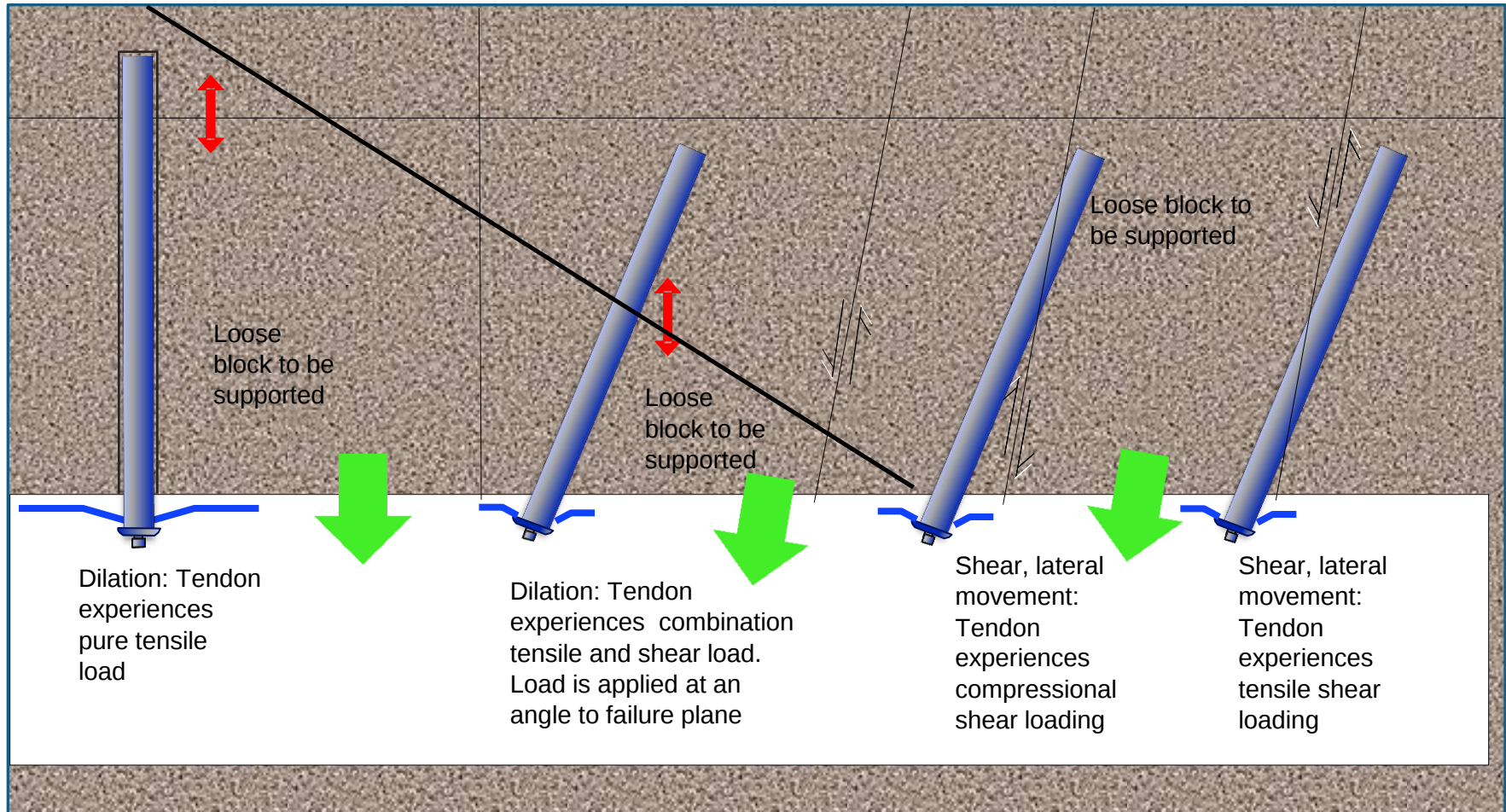
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# Resultant Loading

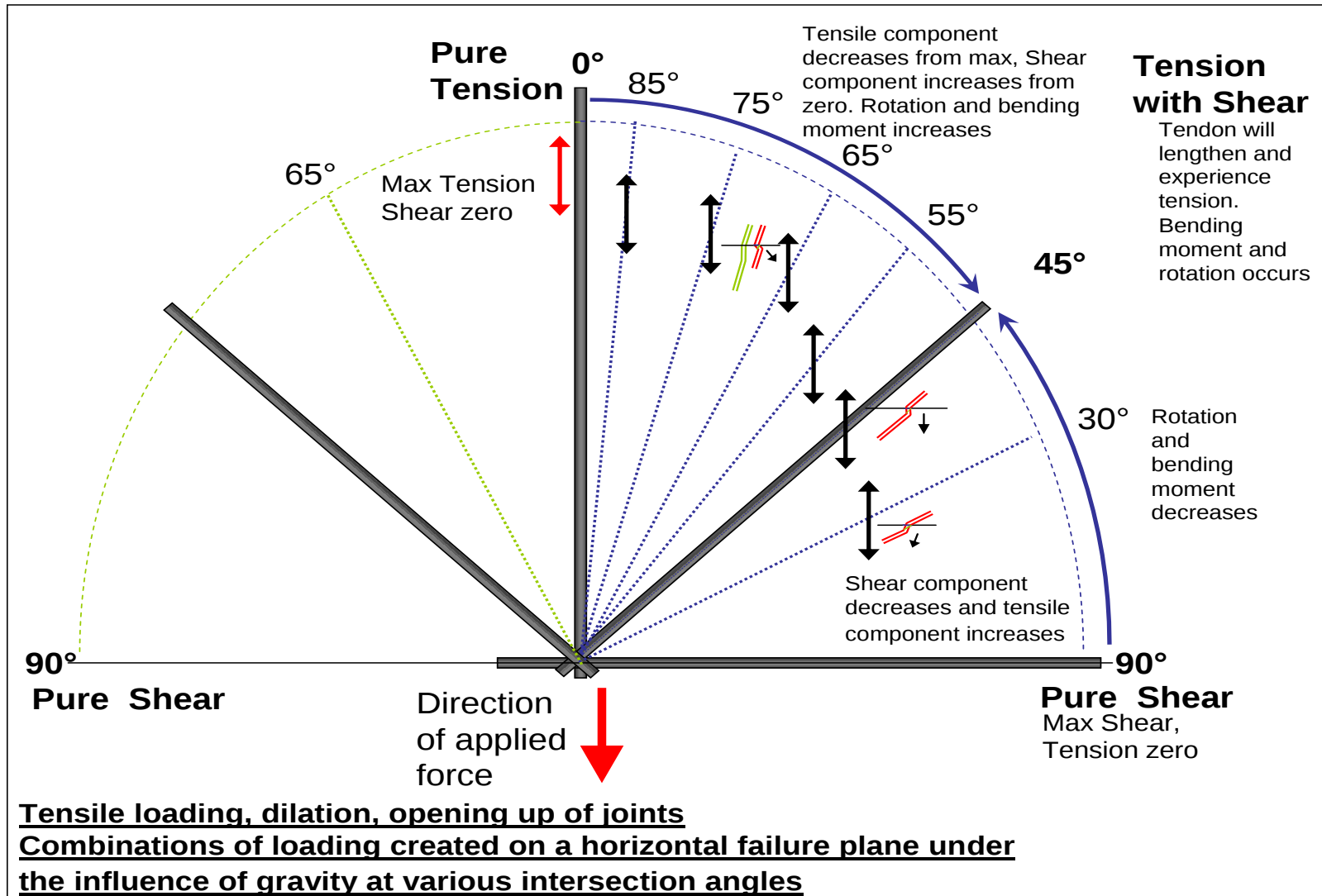


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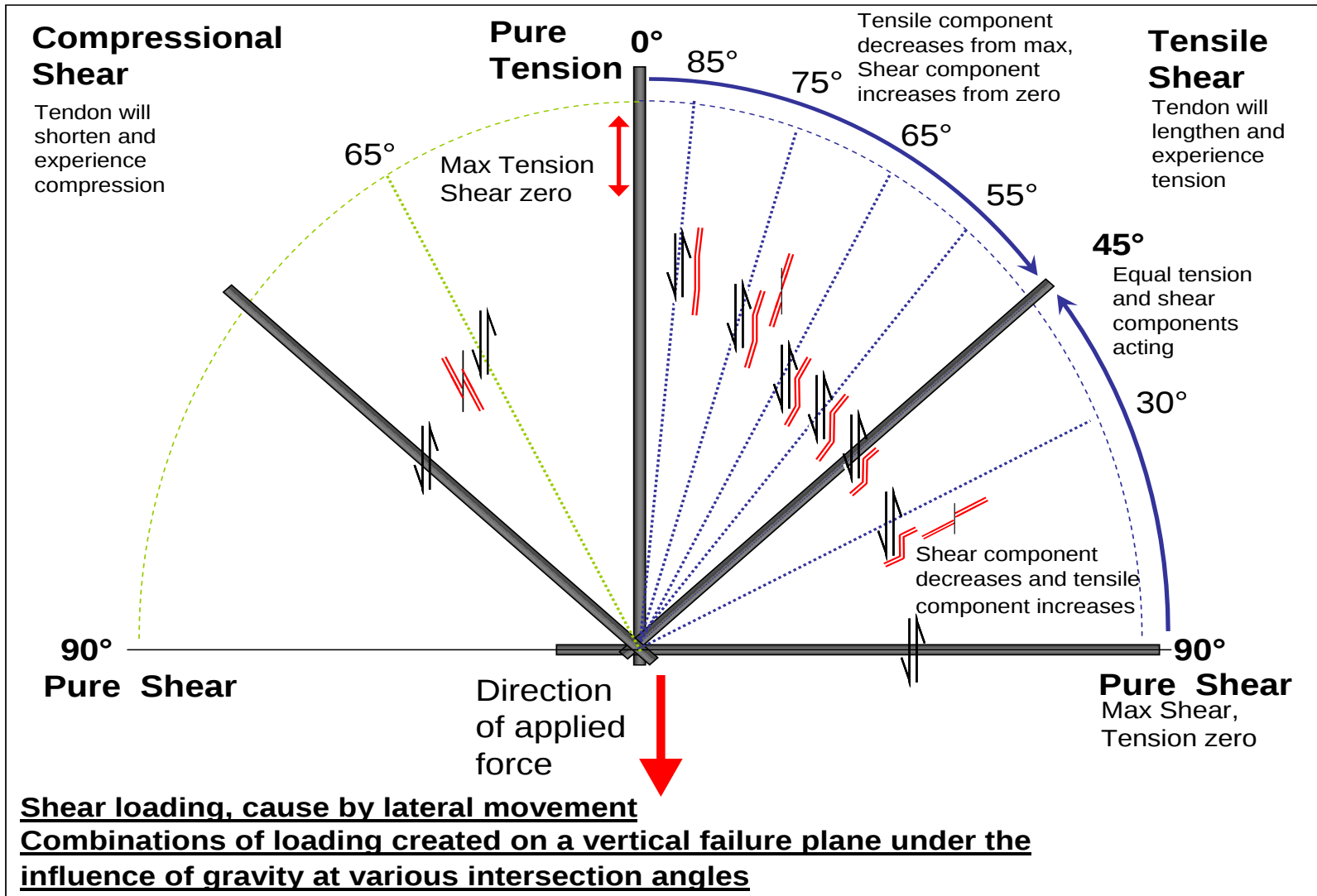
# Combination Loading



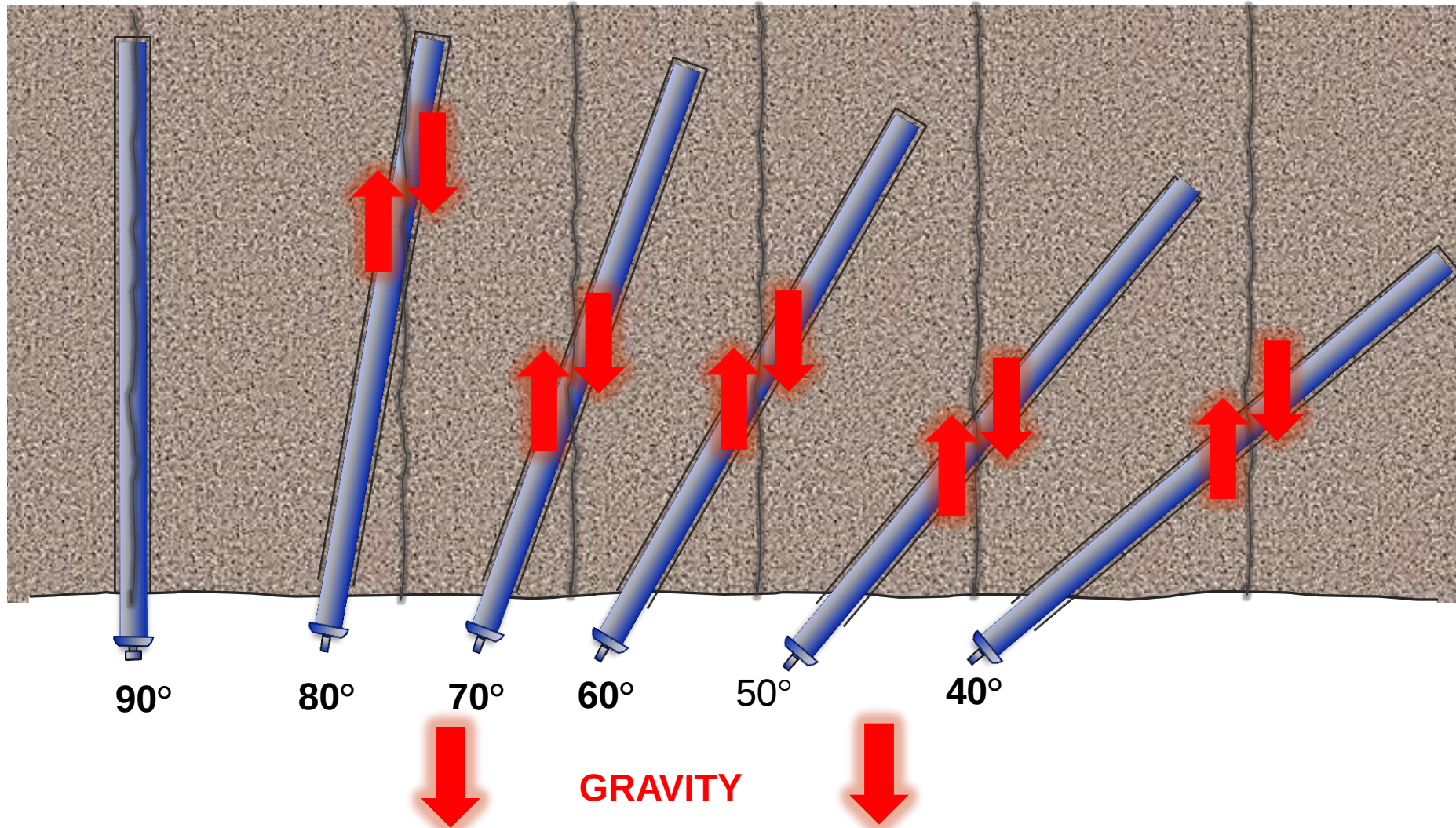
# Combination Loading



# Combination Loading

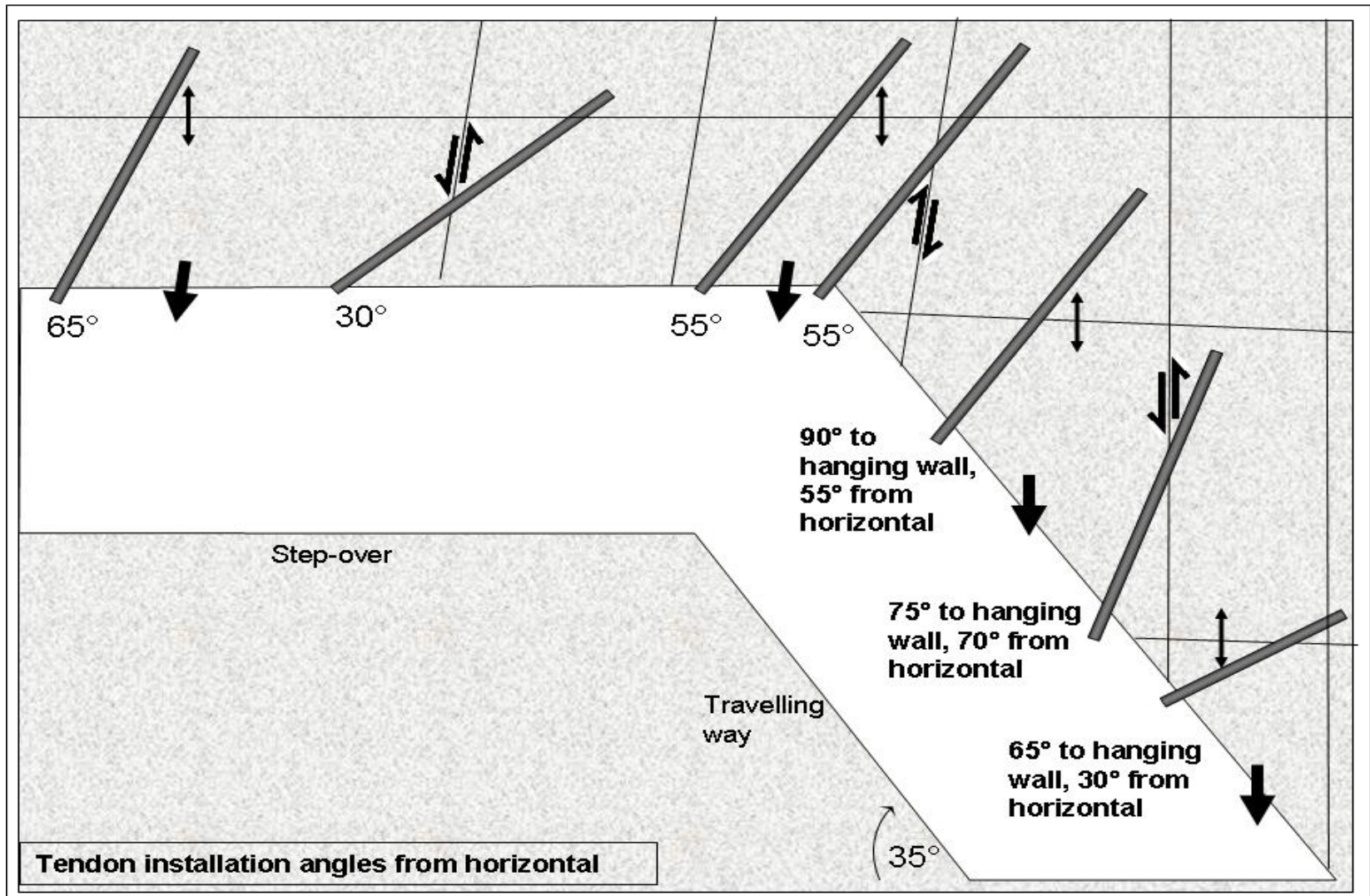


# Installation Angle



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# Excavation Orientation

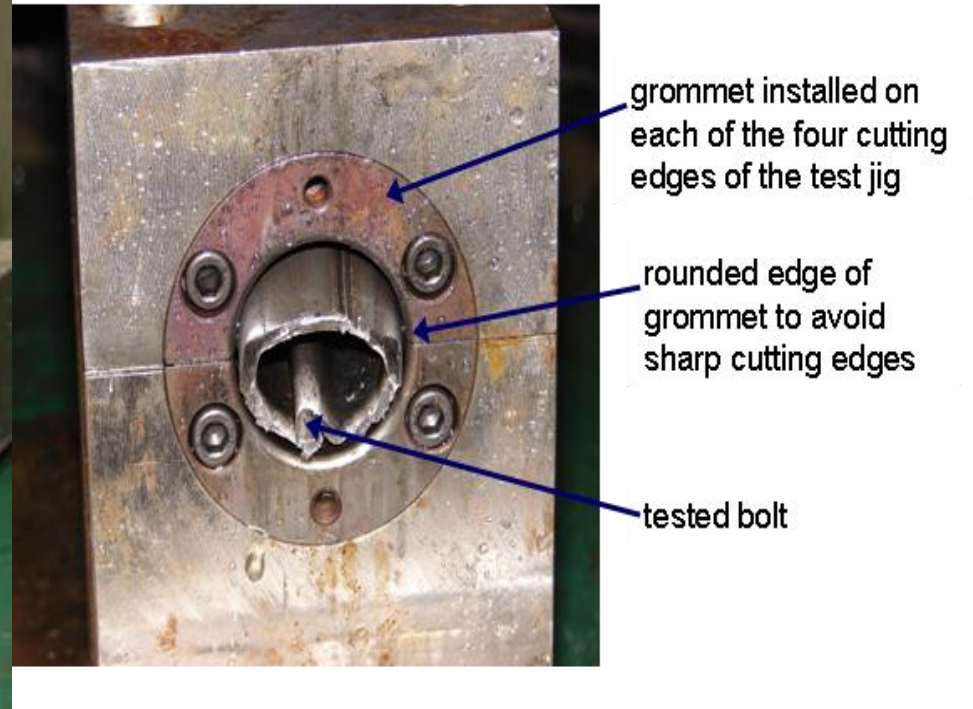


# Bolt Profile in Hole



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# Double Shear Test



# Double Shear Test



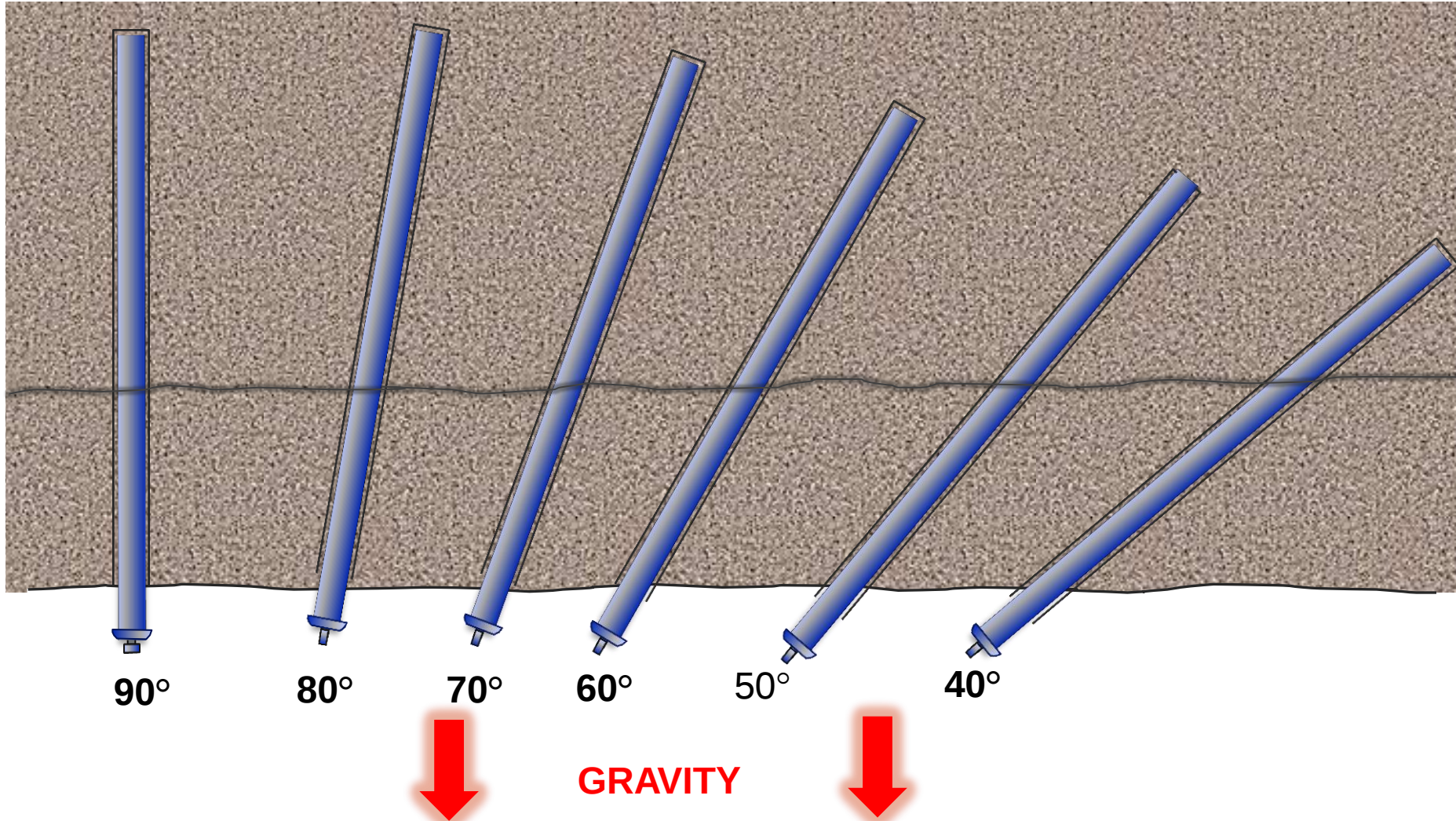
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# Bending Tests



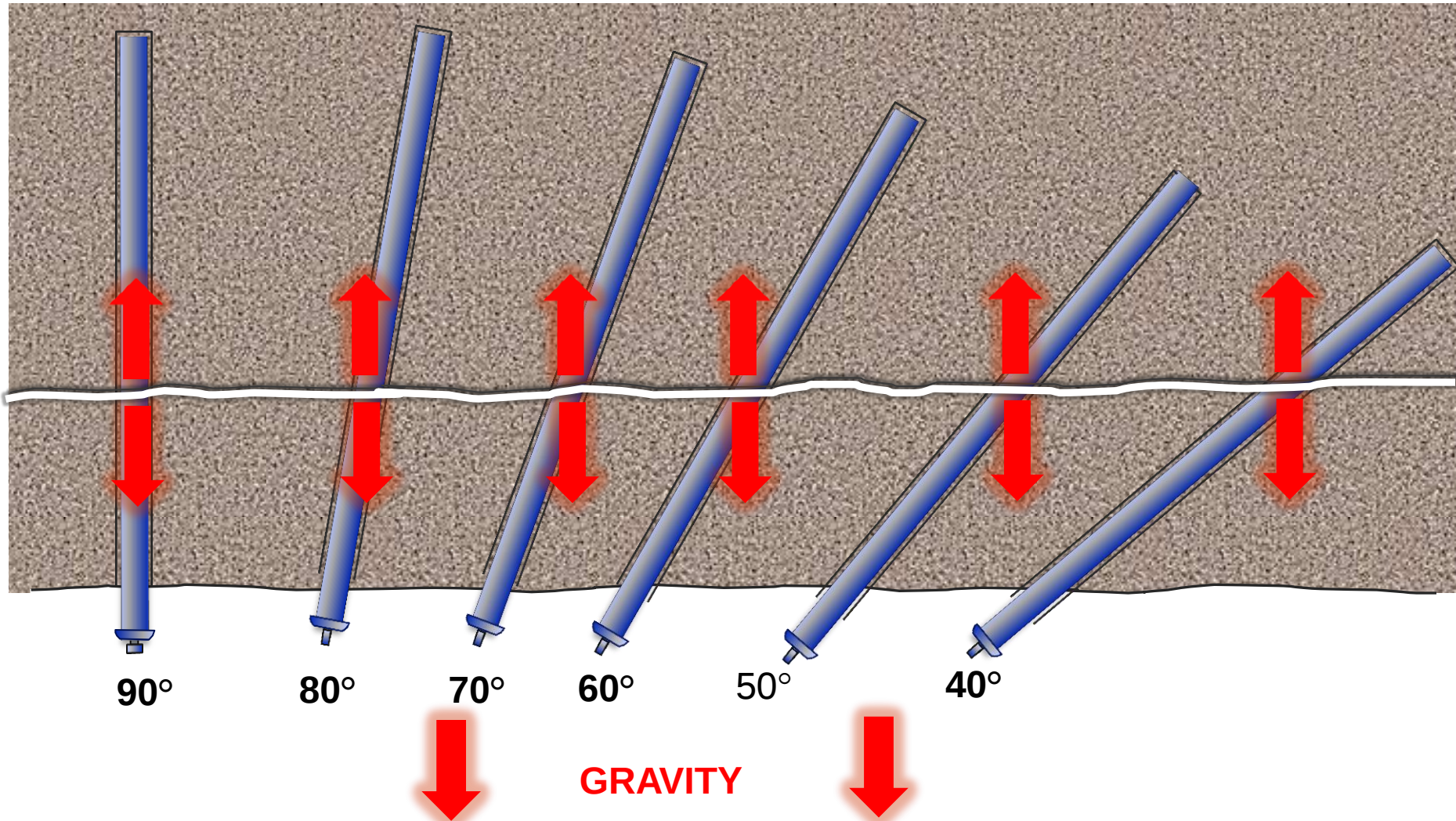
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# Installation Angle



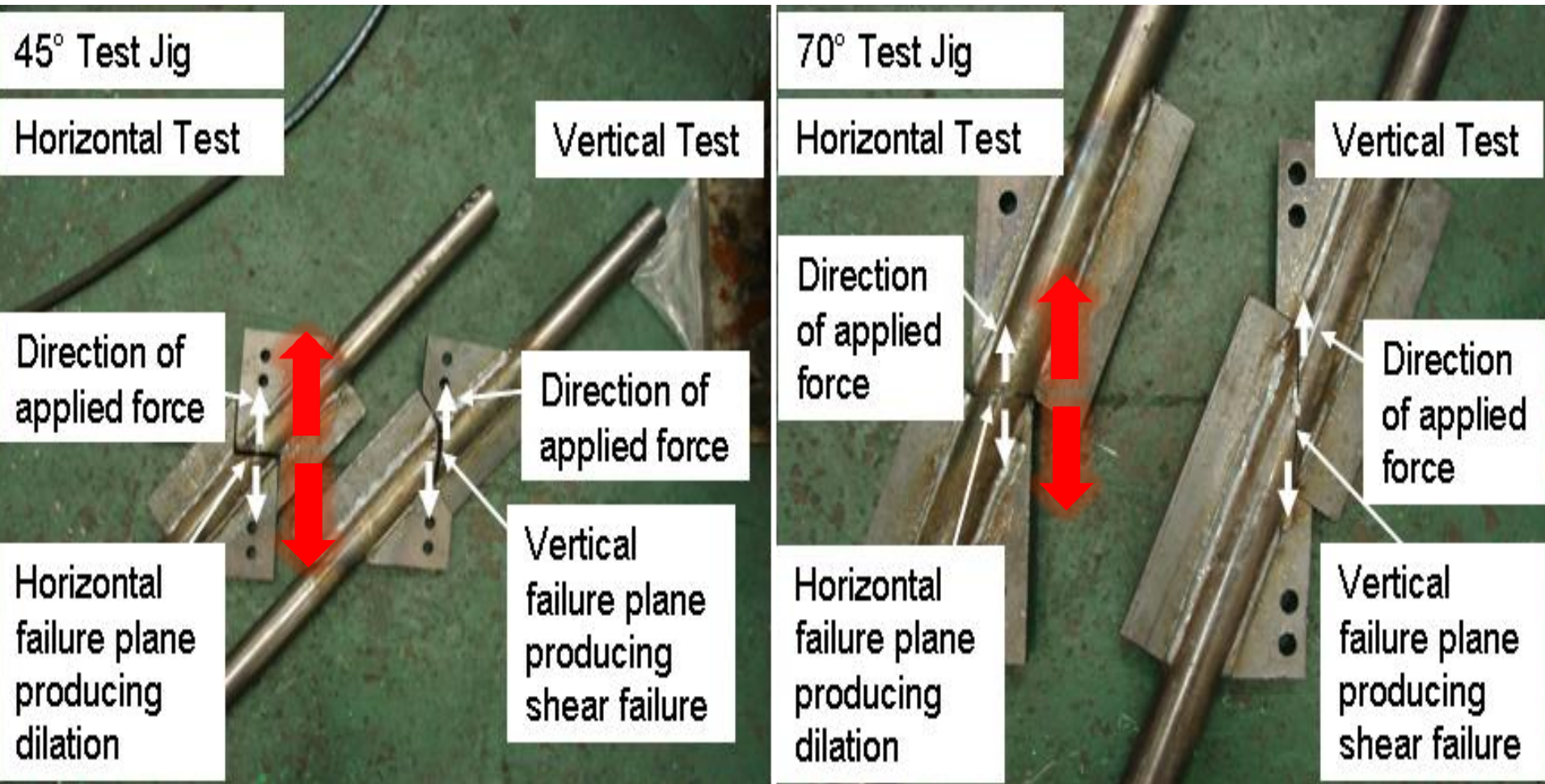
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# Installation Angle

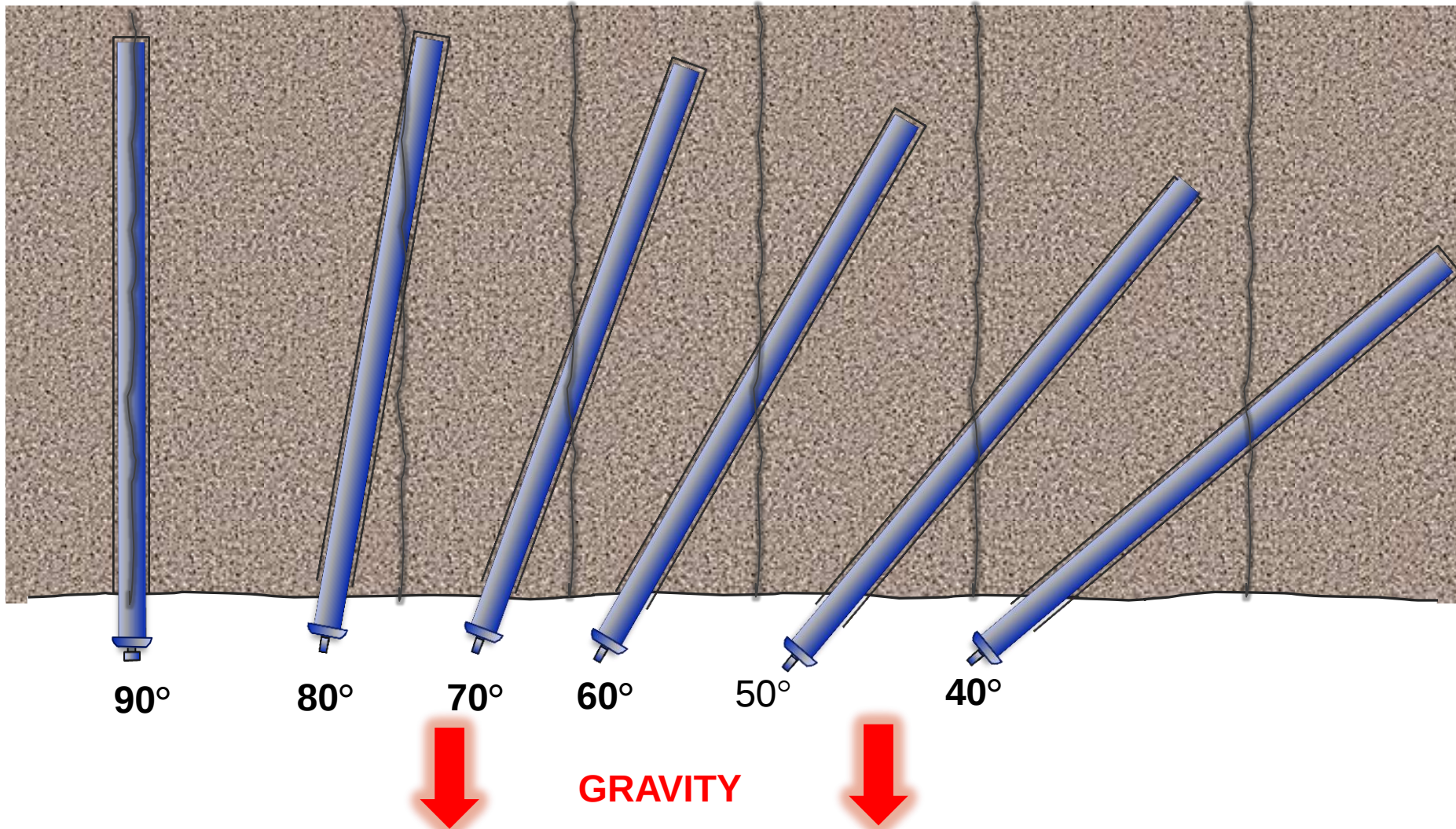


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# Test Jigs

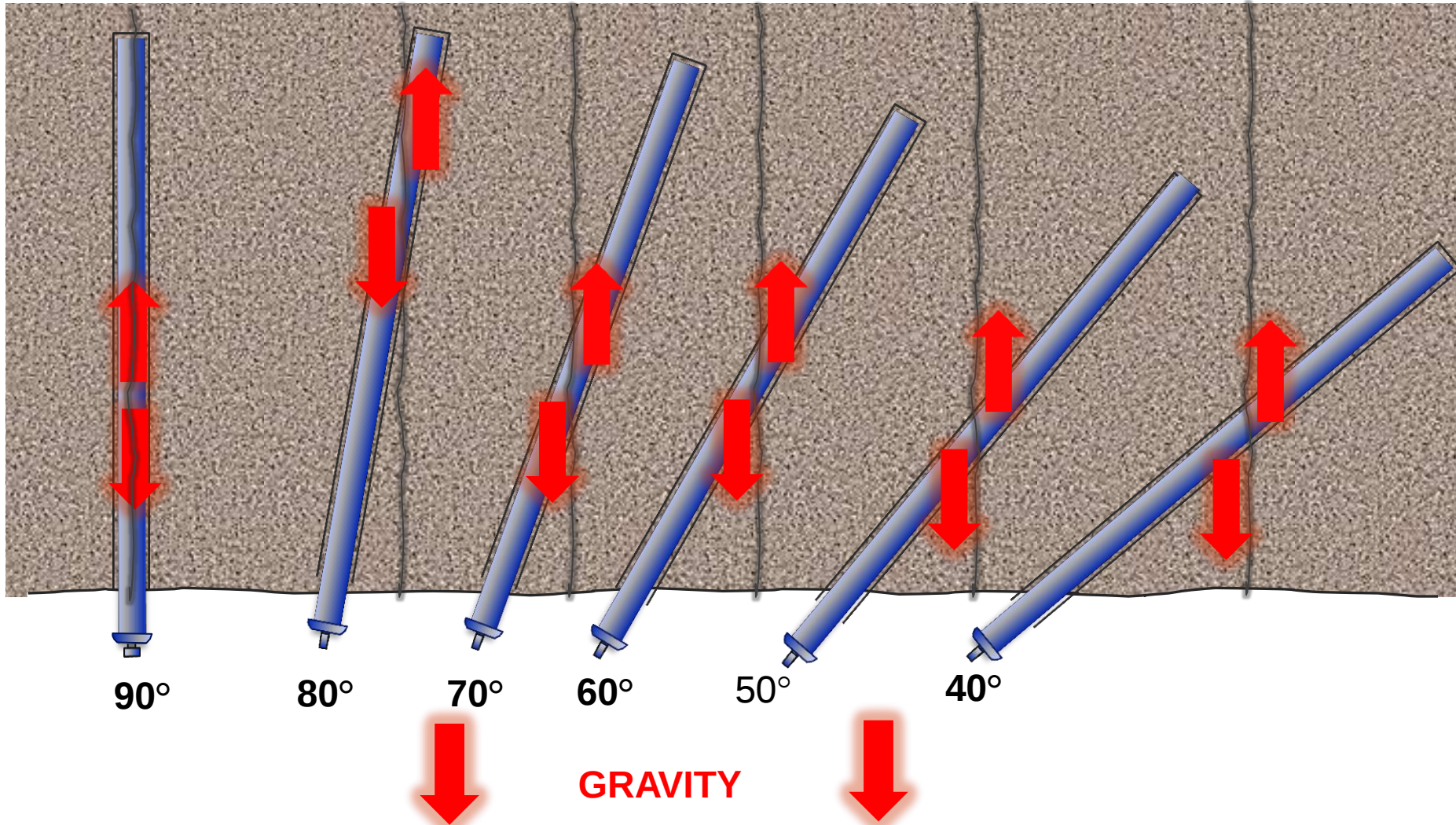


# Installation Angle



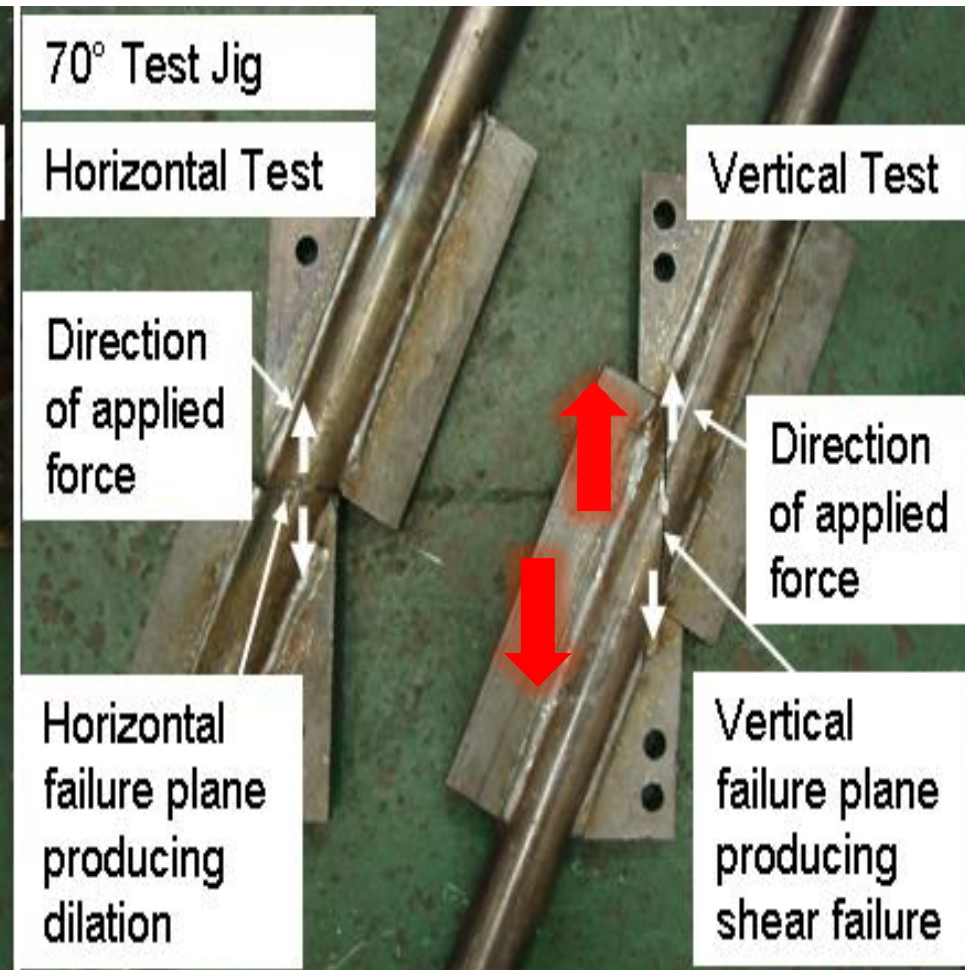
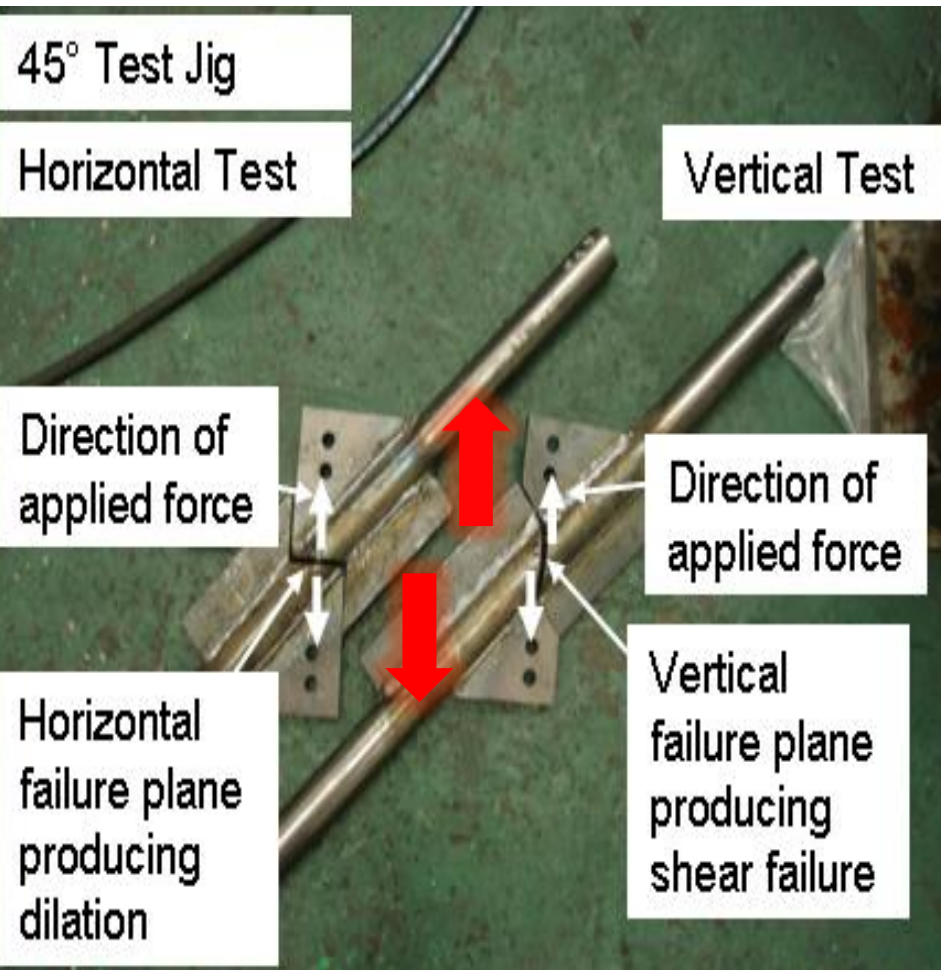
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# Installation Angle



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# Test Jigs



# Testing Process



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# Horizontal Test

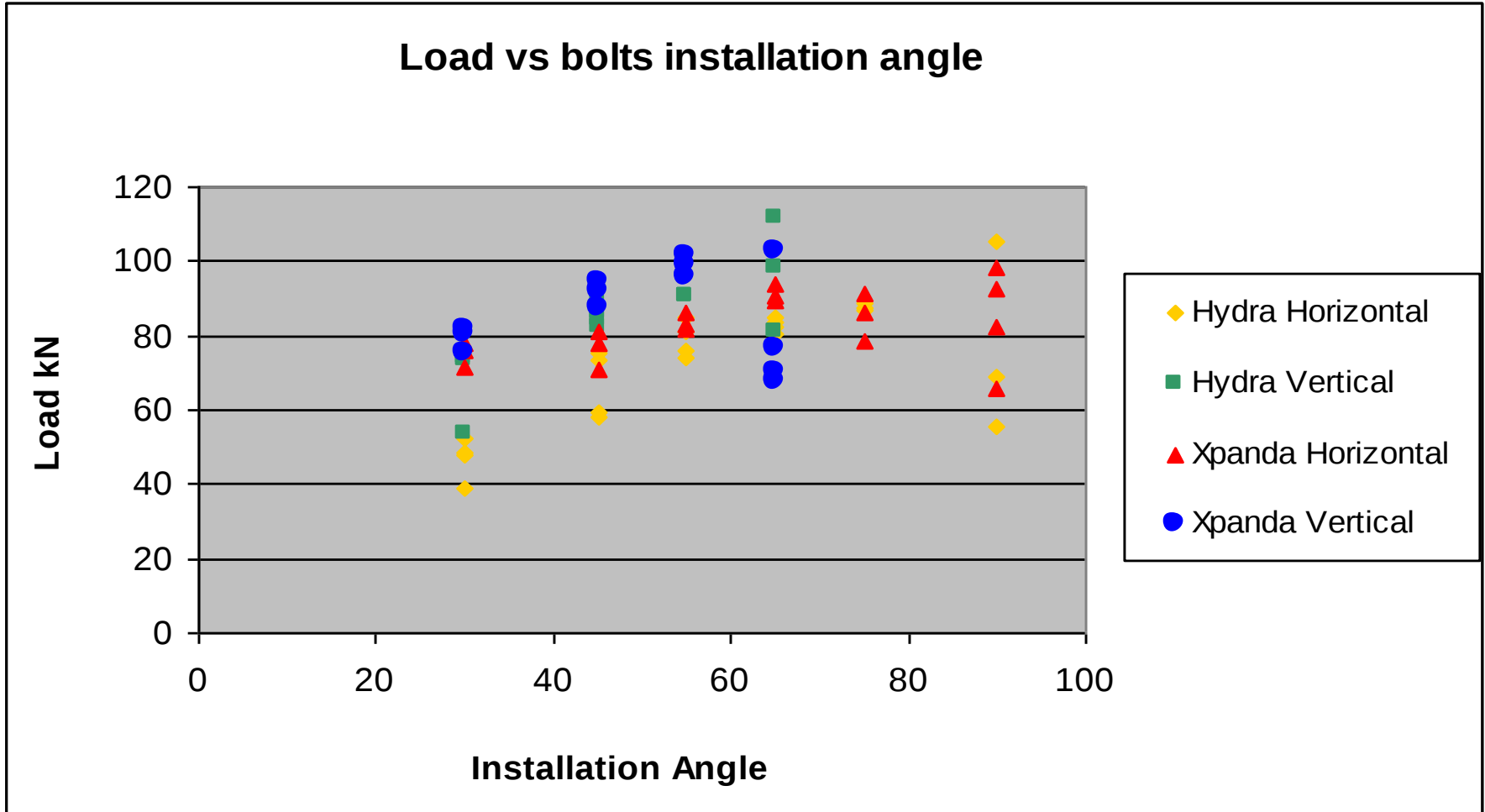


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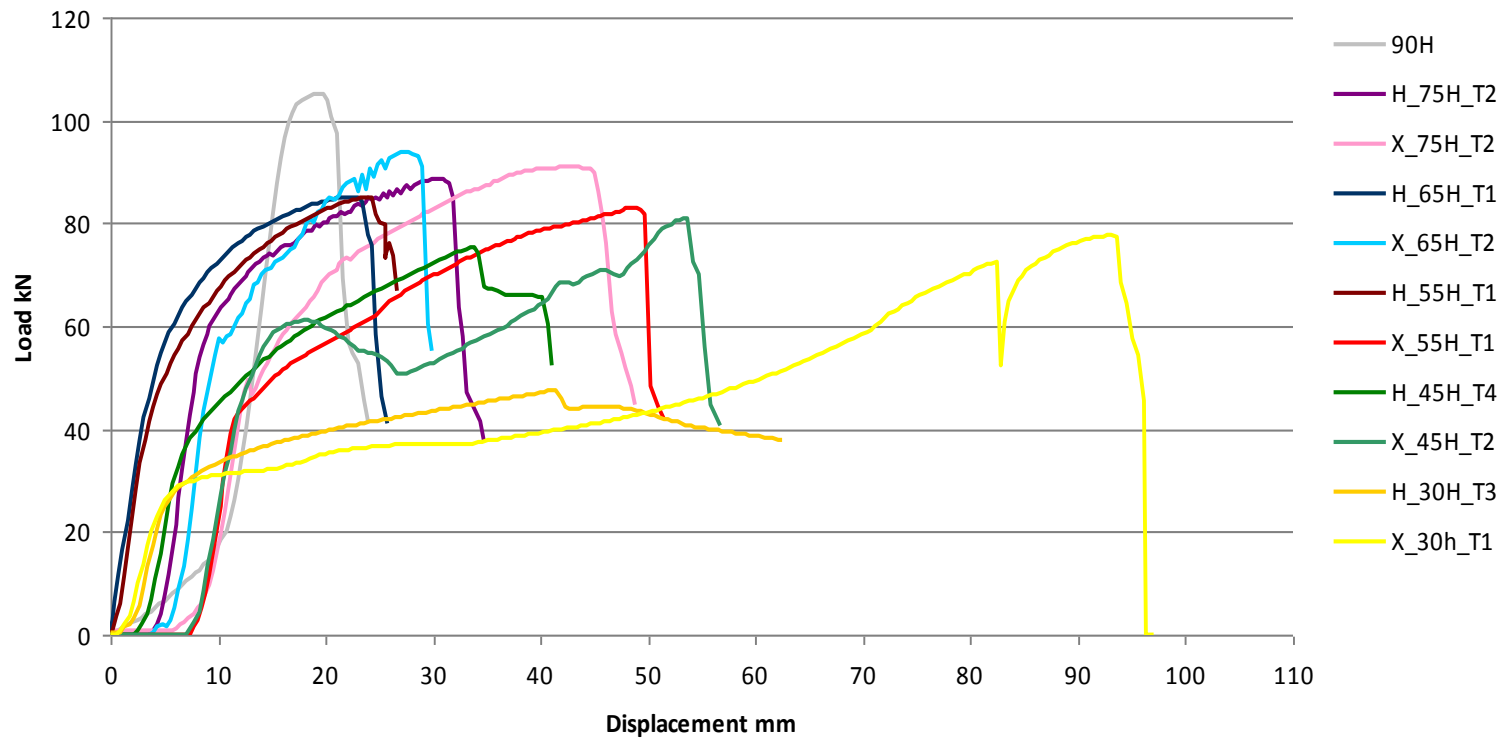
# Tensile Failure



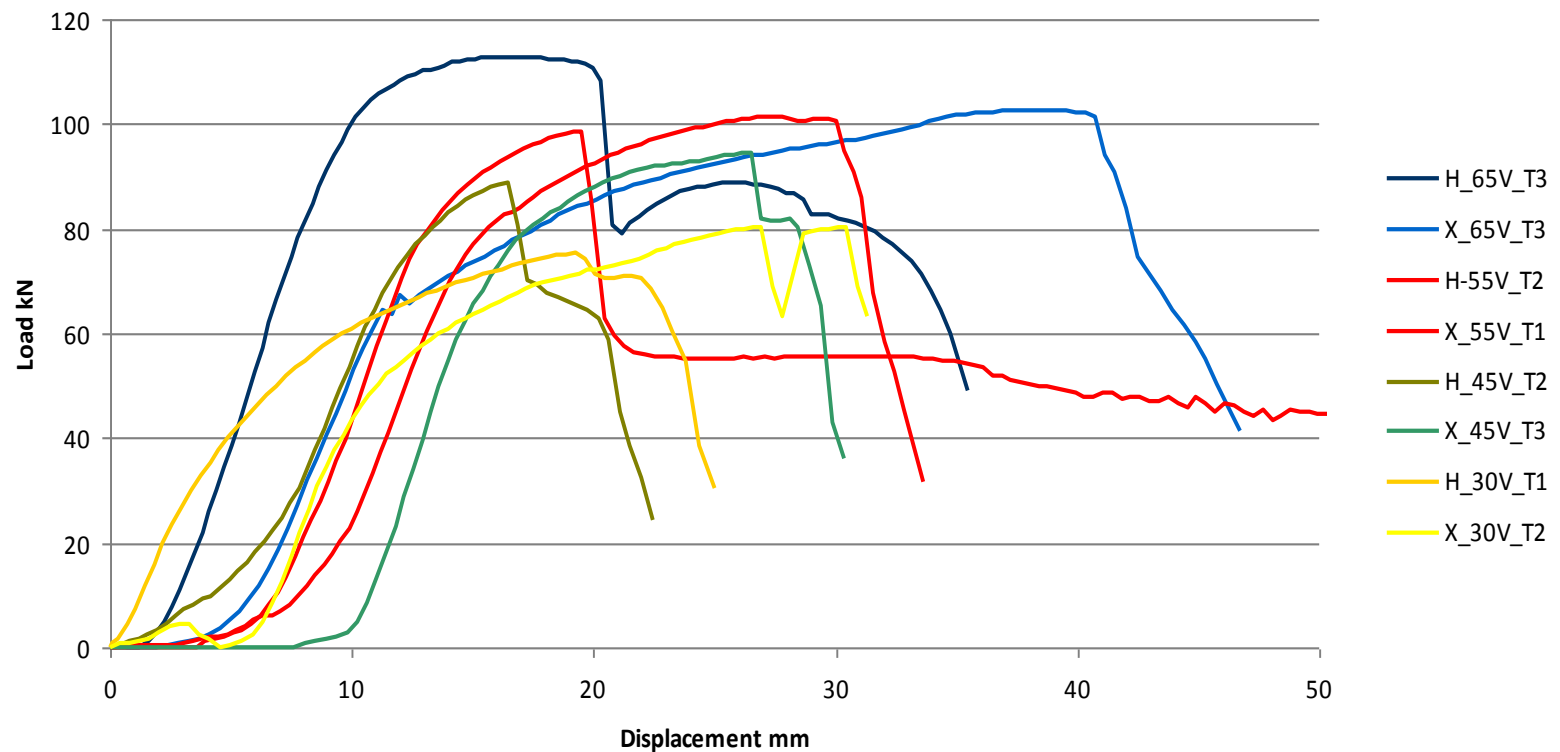
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## Combination Tests Horizontal Failure Plane - All Angles



## Combination Tests Vertical Failure Plane - All Angles



- Does tendon support work?
- Is the design complete?
- Do we know enough?
- Do we really understand how tendons support reacts in a real rock mass and under different loading situations?
- Is this critical information?
- Does it need more investigation?
- Can designs be improved?

# Questions?



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