MKAJ 1073 ENGINEERING ROCK MECHANICS

EFFECT OF DISCONTINUITY ORIENTATION

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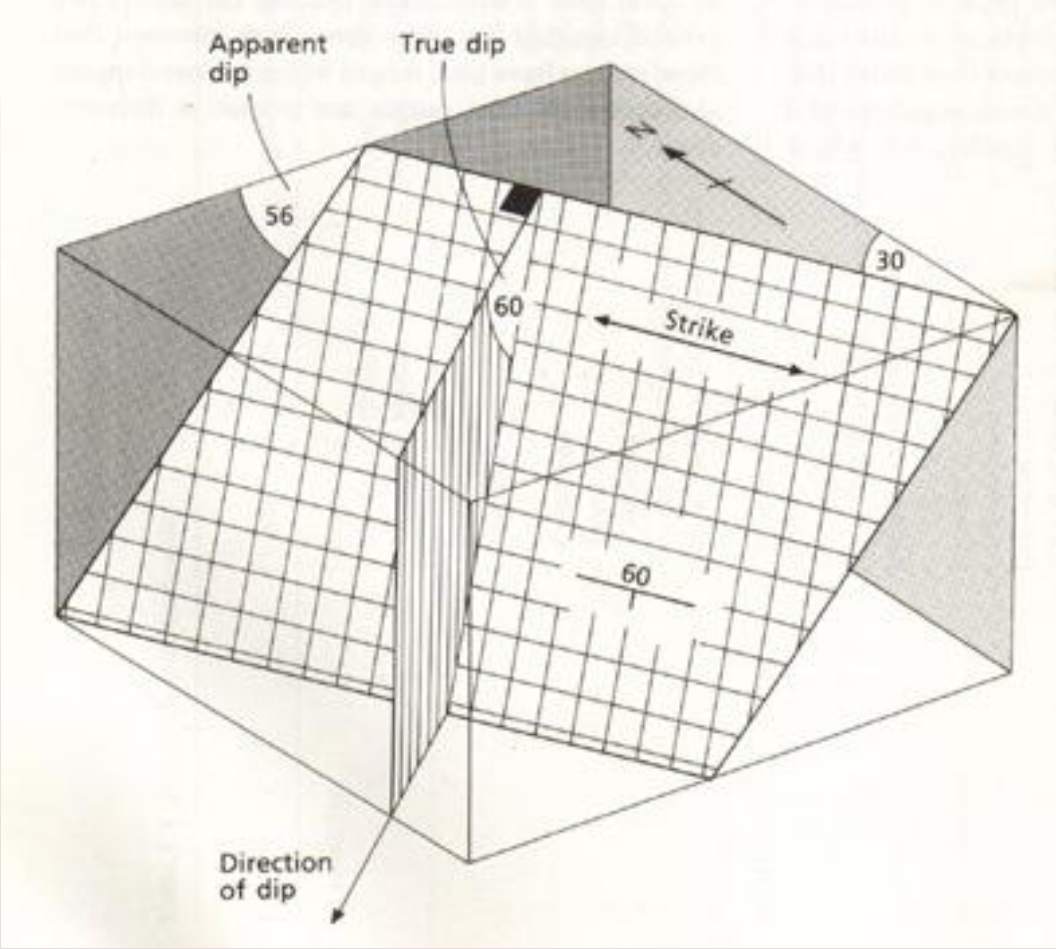
Presence of discontinuities (joints & bedding planes) may affect stability of excavation in rock (tunnel & slope).

Geological information like types of discontinuities and their geometrical data (dip & dip direction) are essential for determining modes of instability & direction of sliding

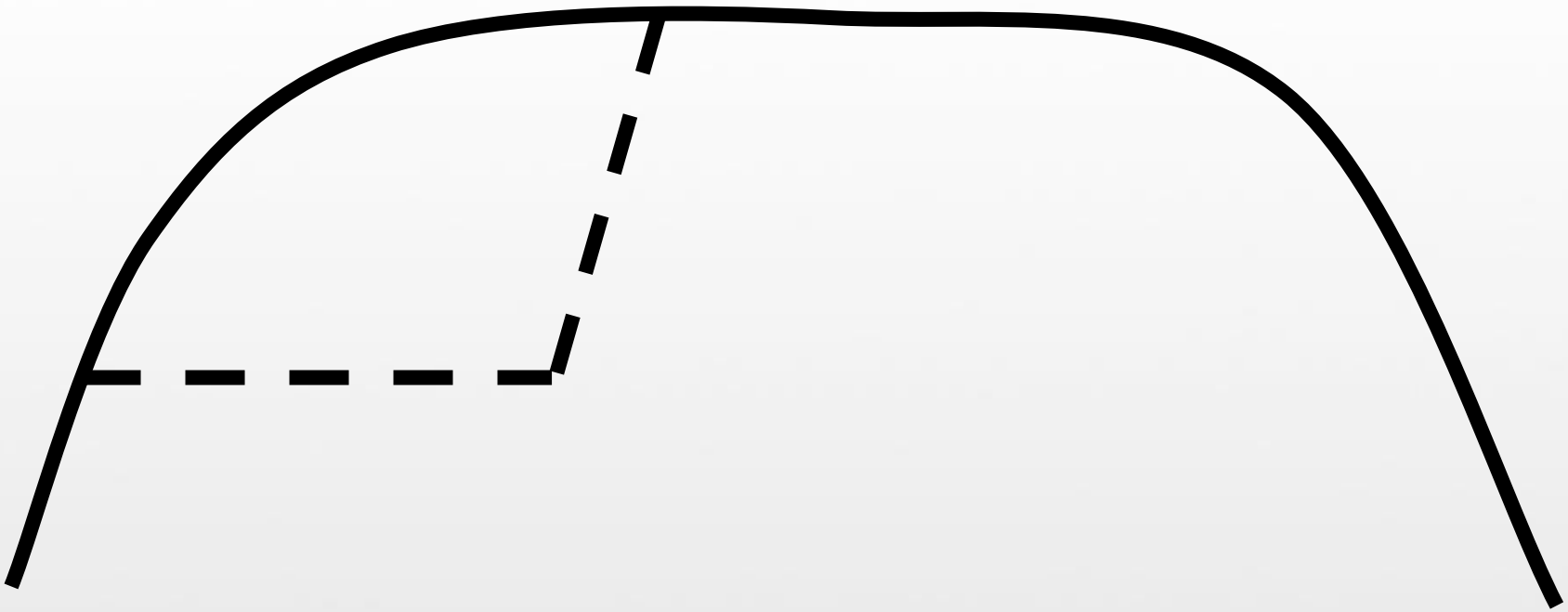
Orientation of discontinuities means the DIP and STRIKE of discontinuities (weakness planes).



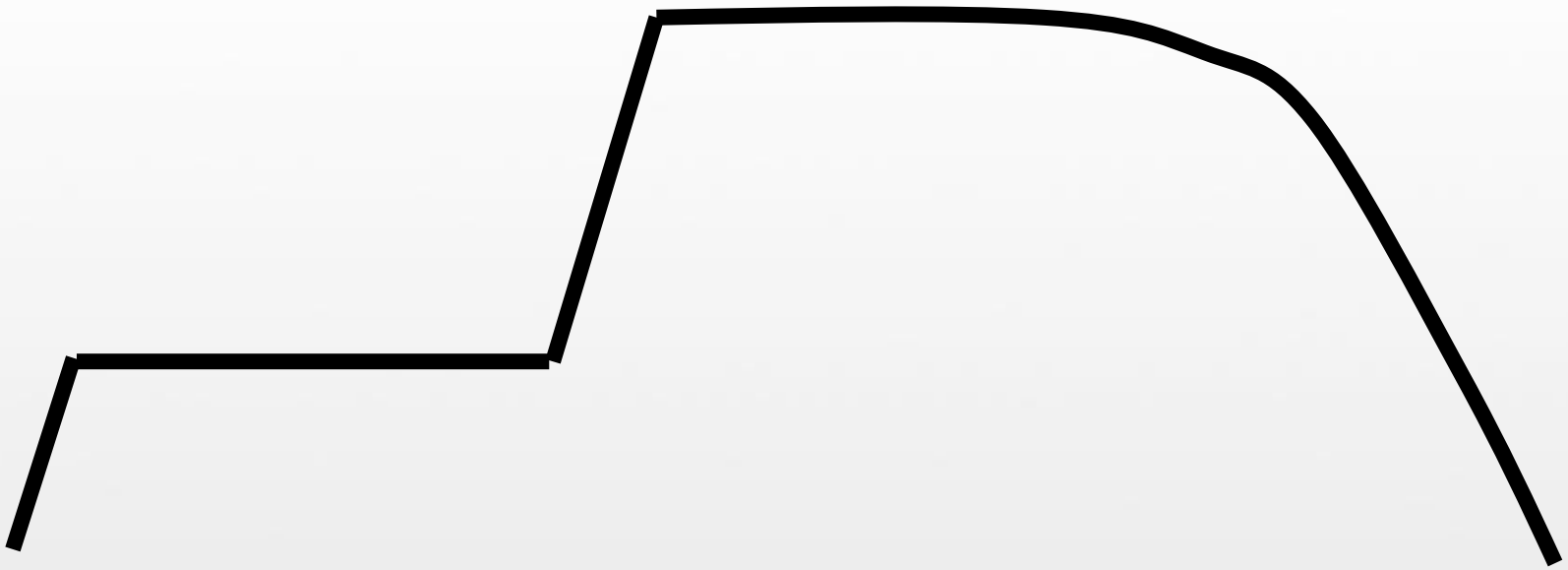
Joint measurement using BRUNTON COMPASS

Take a very strong rock mass, continuous (solid, no weakness planes/discontinuities) & fresh (unweathered, Zone 1)

Note: slope height, H ≈ [UCS/γ]
Parameters UCS & γ are obtained from lab tests on small (intact) rock samples



Can a near vertical slope be excavated in this rock mass, any problem on stability (????)



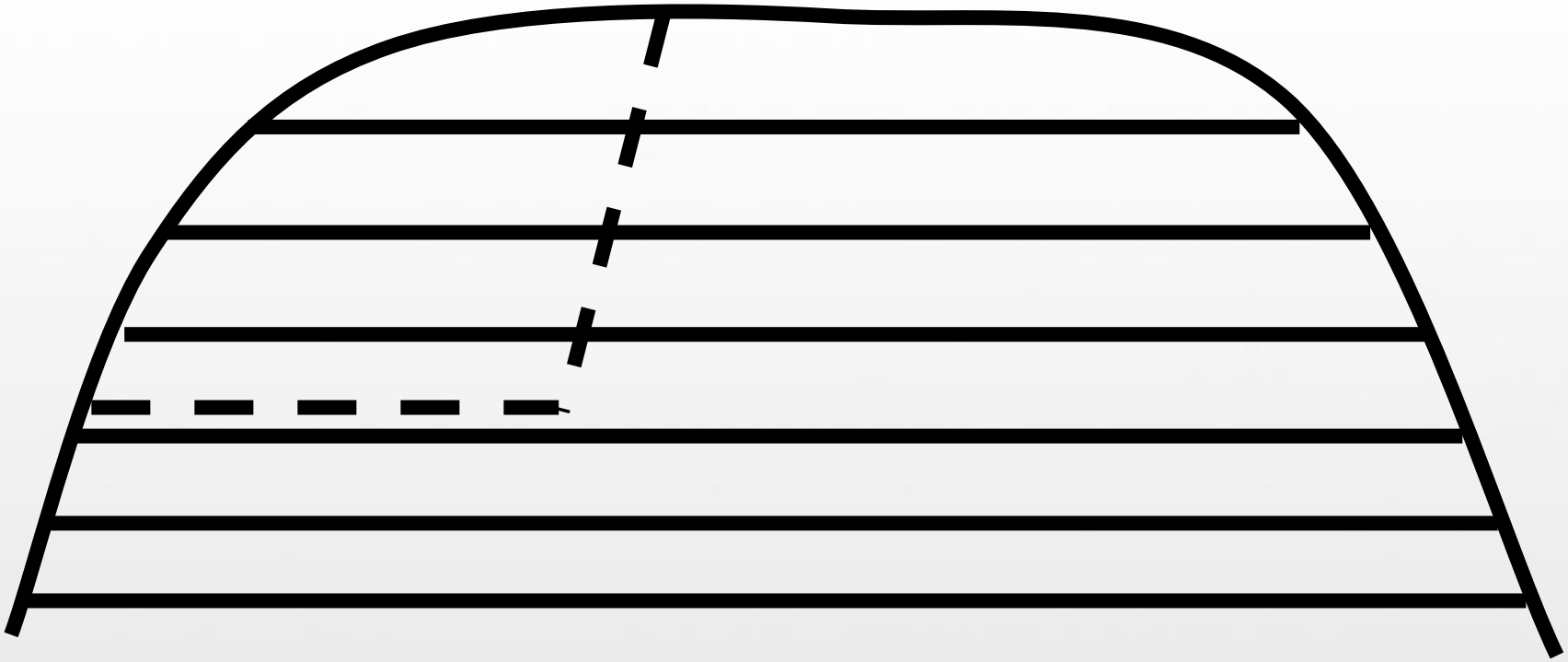
. . . . . in terms of rock mass properties of the 'ideal' rock, a vertical slope is possible

e.g. for granite (UCS = 120 MPa, γ = 26 kN/m3) slope of few km high is possible !!!

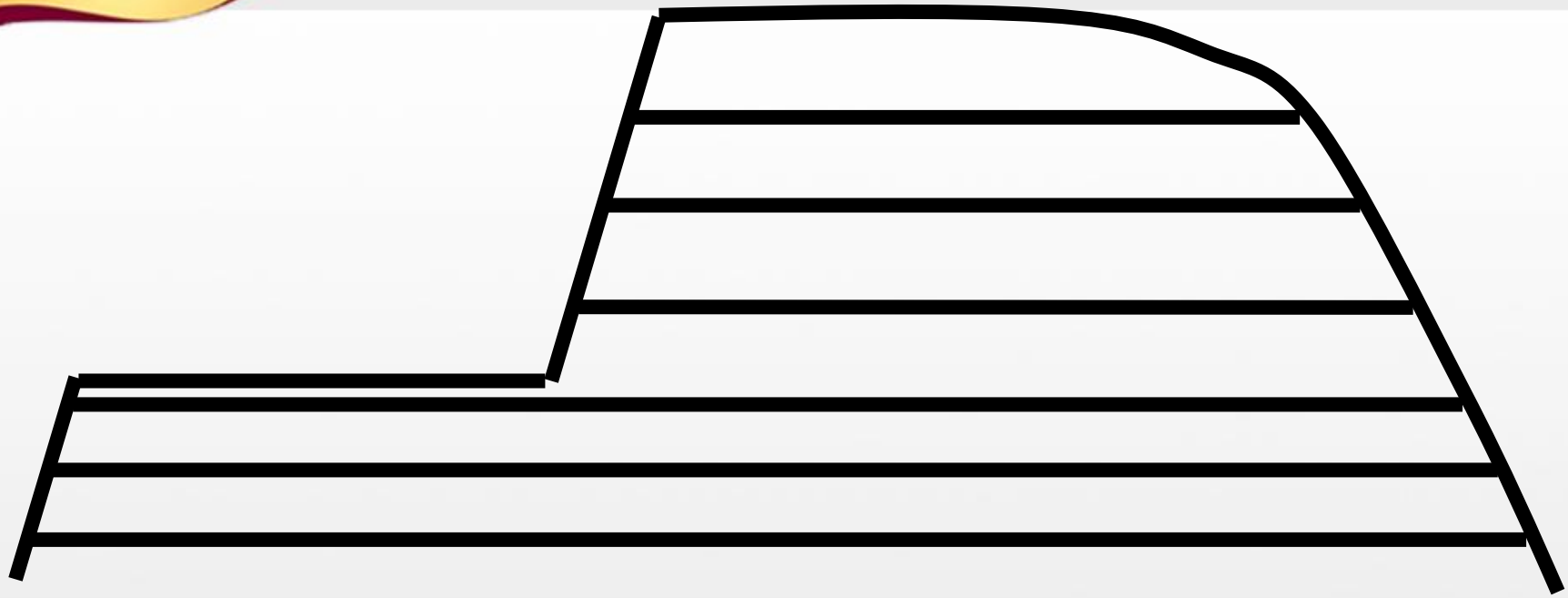
Types of structural discontinuity	Rock types		
	Igneous	Sedimentary	Metamorphic
LARGE-SCALE:			
Fault plane	√	√	√
Joint plane	√	√	√
Bedding plane	-	√	√
SMALL-SCALE:			
Lamination	-	√	-
Foliation	-	-	√
Microfractures	√	√	√
Voids	-	√	√

But rock masses always exhibit discontinuities, more than one types & at different orientations

Typical slope face .... discontinuous, fresh (Grade I) to completely weathered (Grade V) rock

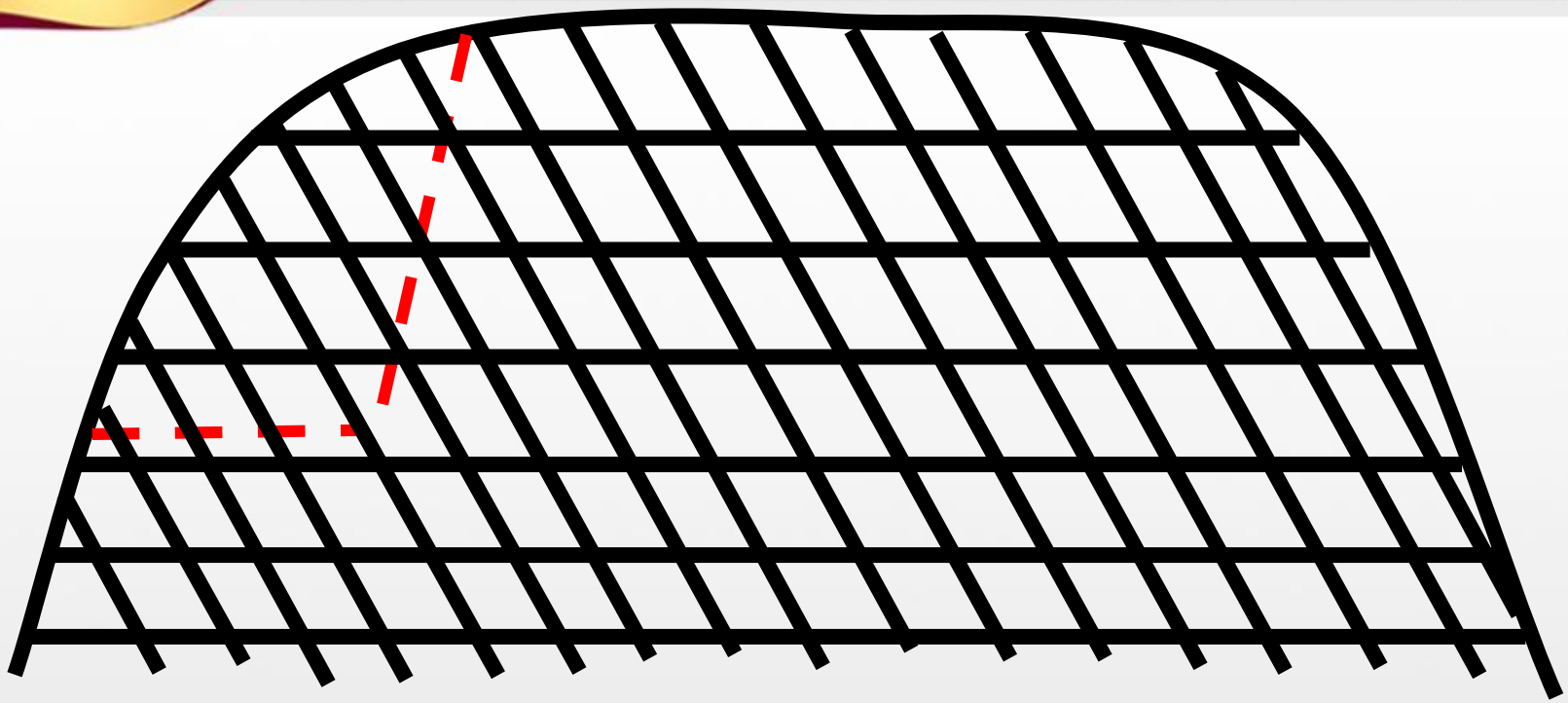


A slope face cut in a fresh (zone 1) and very strong rock mass but, with horizontal bedding planes (discontinuity or weakness plane) . . . . .

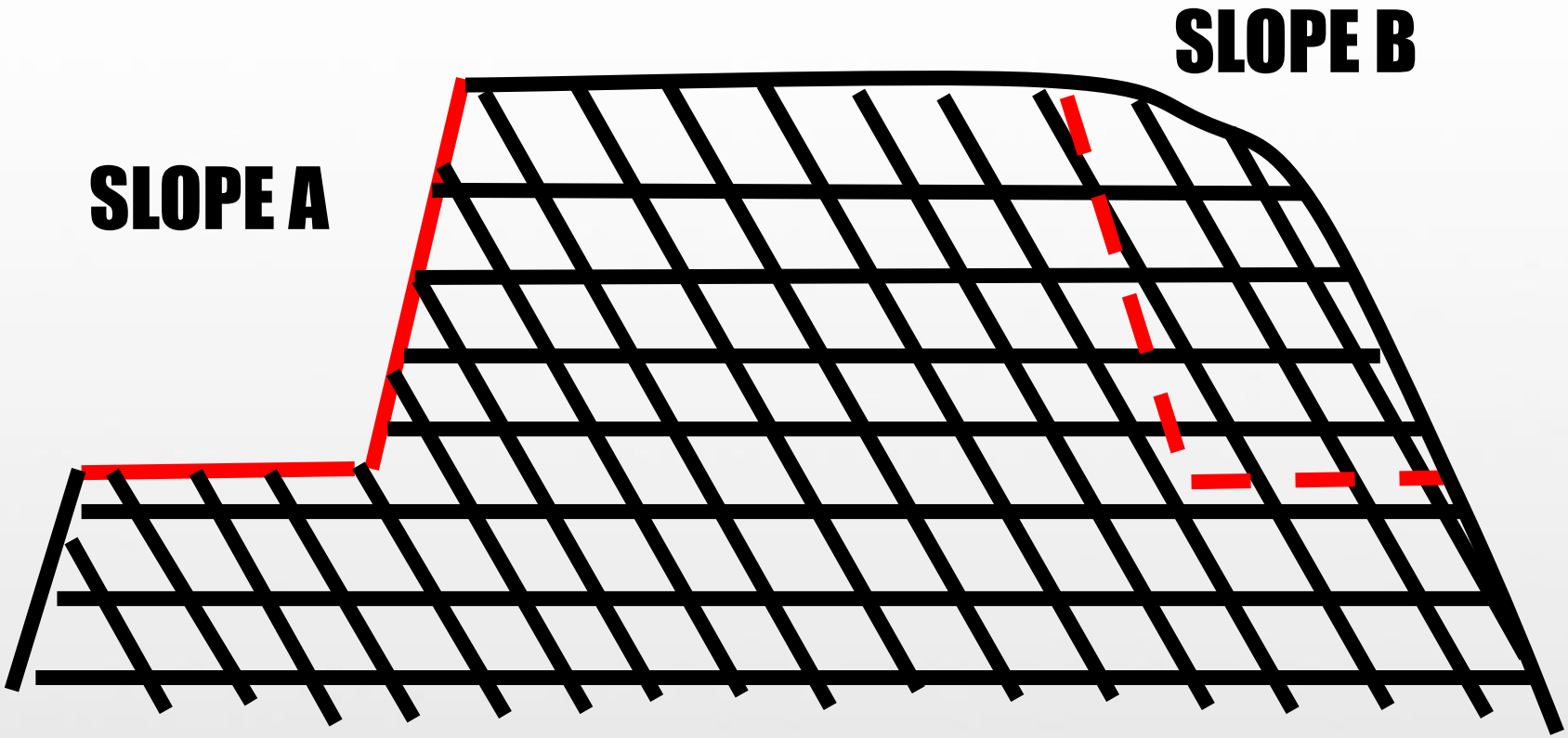


Will the stability of the cut slope be affected by the horizontal bedding planes?

Is there any immediate effect due to rock mass properties & bedding planes?

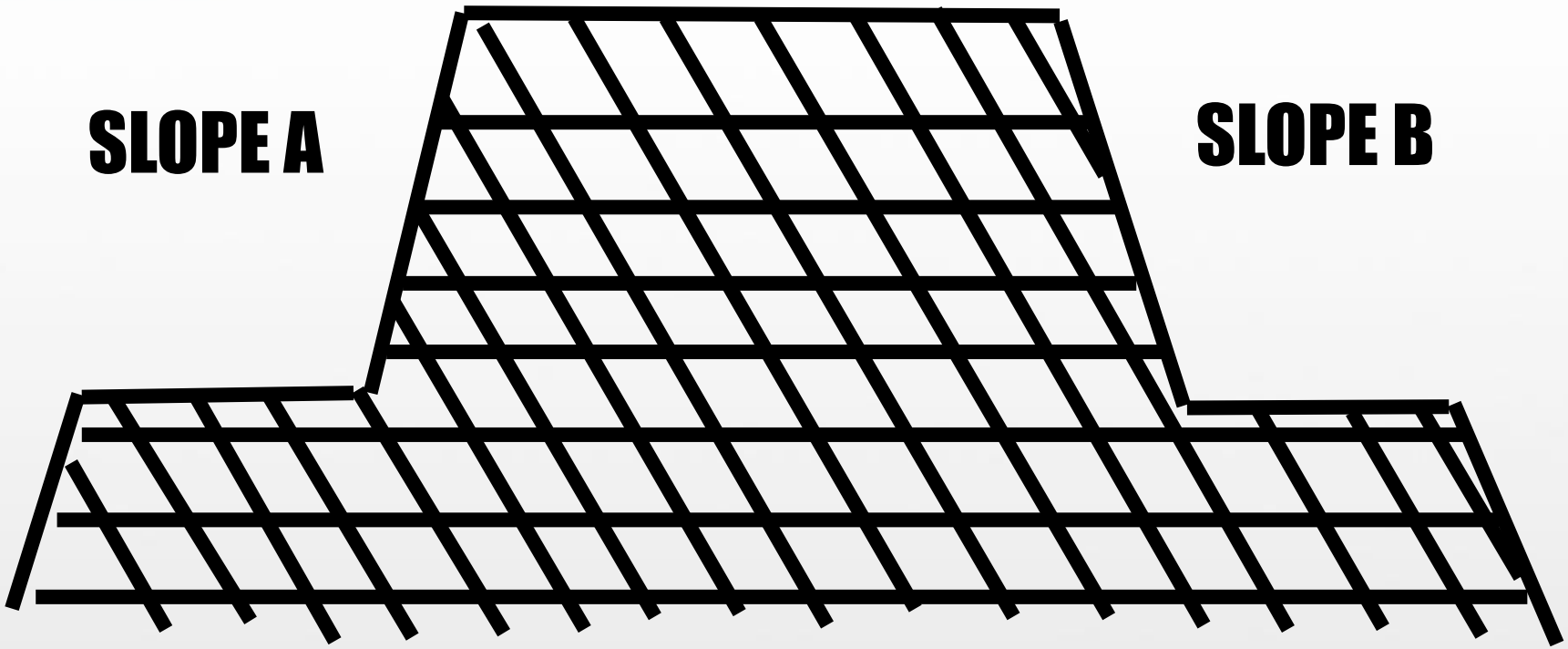


A slope face cut in fresh & strong rock mass with horizontal bedding planes and inclined fracture planes (e.g. joints)



For slope (A), is the stability being affected by the horizontal bedding & inclined joint planes?

Let propose another slope (B) on the other side of the hill . . . .



The rock properties & the horizontal bedding planes have no immediate effect on the stability of both SLOPE A and B.
However, with respect to the orientation of the inclined joints, SLOPE B is critical

References:

1. **Brady, B.H.G. and Brown, E.T. (1985), Rock Mechanics for Underground Mining, George Allen & Unwin, London.**
2. **Hoek, E. & Bray, J.W. (1981), Rock Slope Engineering, 3rd ed. Inst. Mining & Metallurgy, London.**
3. **Hudson, J.A., (1989), Rock Mechanics Principles in Engineering Practice, CIRIA, Butterworths.**
4. **ISRM (1981), Rock Characterisation Testing and Monitoring, ISRM Suggested Methods, Commission on testing methods, Int. Society of Rock Mechanics, Brown E.T. (ed.), Pergamon Press, Oxford.**