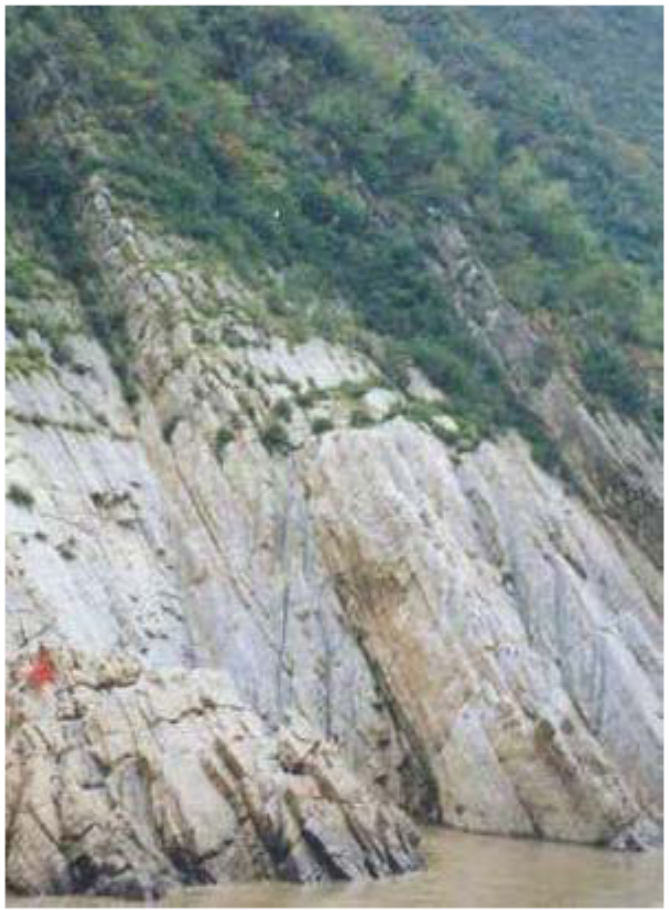
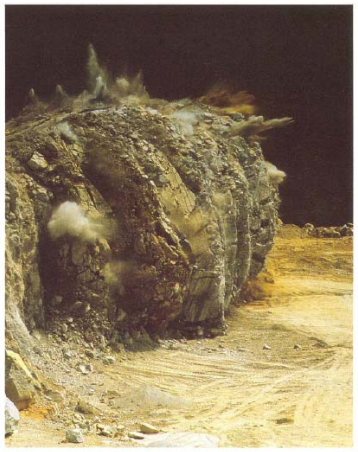
Rock Slopes

Slopes can be divided into natural slopes and excavated slopes.



Rock Slopes

Rock slope engineering including slope excavation design and methods, slope stability analysis, rock slope support design and methods, and slope protection measures, will be covered in later year.

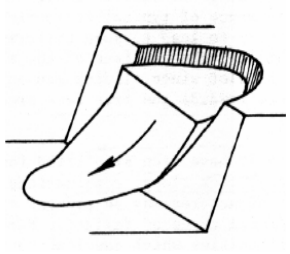


Failure of Rock Slopes

Failure of Rock Slopes

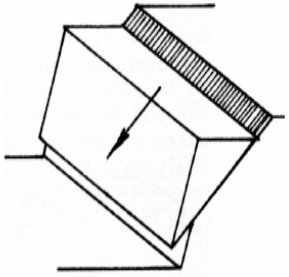
(a) Circular Failure

Usually occurs in waste rock, heavily fractured rock and weak rock, with no identifiable structural pattern.



(b) Plane Failure

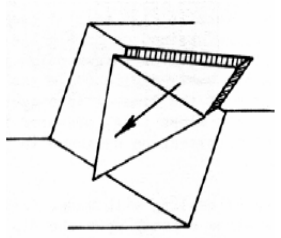
Occurs in rocks with plane discontinuities, e.g., bedding planes.



Failure of Rock Slopes

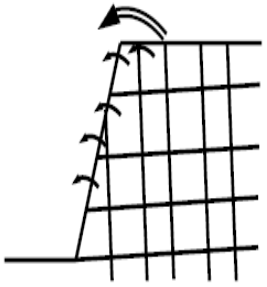
(c) Wedge Failure

Occurs in rocks with intersecting discontinuities forming wedges.



(d) Toppling failure

Occurs in rocks with columnar or block structures separated by steeply dipping discontinuities.



Rock Slopes Analysis

Estimating Rock Slope Failure by Rock Mass Rating

Rock slope stability is a function of rock mass quality. RMR System provides rock mass rating for slope. However, adjustment for joint orientation MUST be applied.

RMR Adjustment = (A x B x C) + D

RMR(s) = RMR + [(A x B x C) + D]

RMR Adjustment = (A x B x C) + D

Adjustment	Very favourable	Favourable	Fair	Unfavourable	Very unfavourable
Joint dip direction – Slope dip direction	>30	30~20	20~10	10~5	<5
A	**0.15**	**0.40**	**0.70**	**0.85**	**1.00**
Joint dip	<20	20~30	30~35	35~45	>45
B	**0.15**	**0.40**	**0.70**	**0.85**	**1.00**
Joint dip – Slope dip	>10	10~0	0	0~-10	<-10
C	**0**	**-6**	**-25**	**-50**	**-60**
Slope formation	Natural slope	Presplitting	Smooth blasting	Blasting/Ripping	Deficient blasting
D	**+15**	**+10**	**+8**	**0**	**-8**

RMR(s) = RMR + [(A x B x C) + D]

RMR(s)	Class	Description	Stability	Failure	Support
81~100	I	Very good	Completely stable	None	None
61~80	II	Good	Stable	Some blocks	Spot
41~60	III	Fair	Partially stable	Some joints or many wedges	Systematic
21~40	IV	Poor	Unstable	Palnar or large wedges	Important / Corrective
0~20	V	Very Poor	Completely unstable	Large wedges or circular failure	Re-excavation