

WEDGE FAILURE

Lesson 6

LESSON 6 - WEDGE FAILURE

Learning Outcomes -

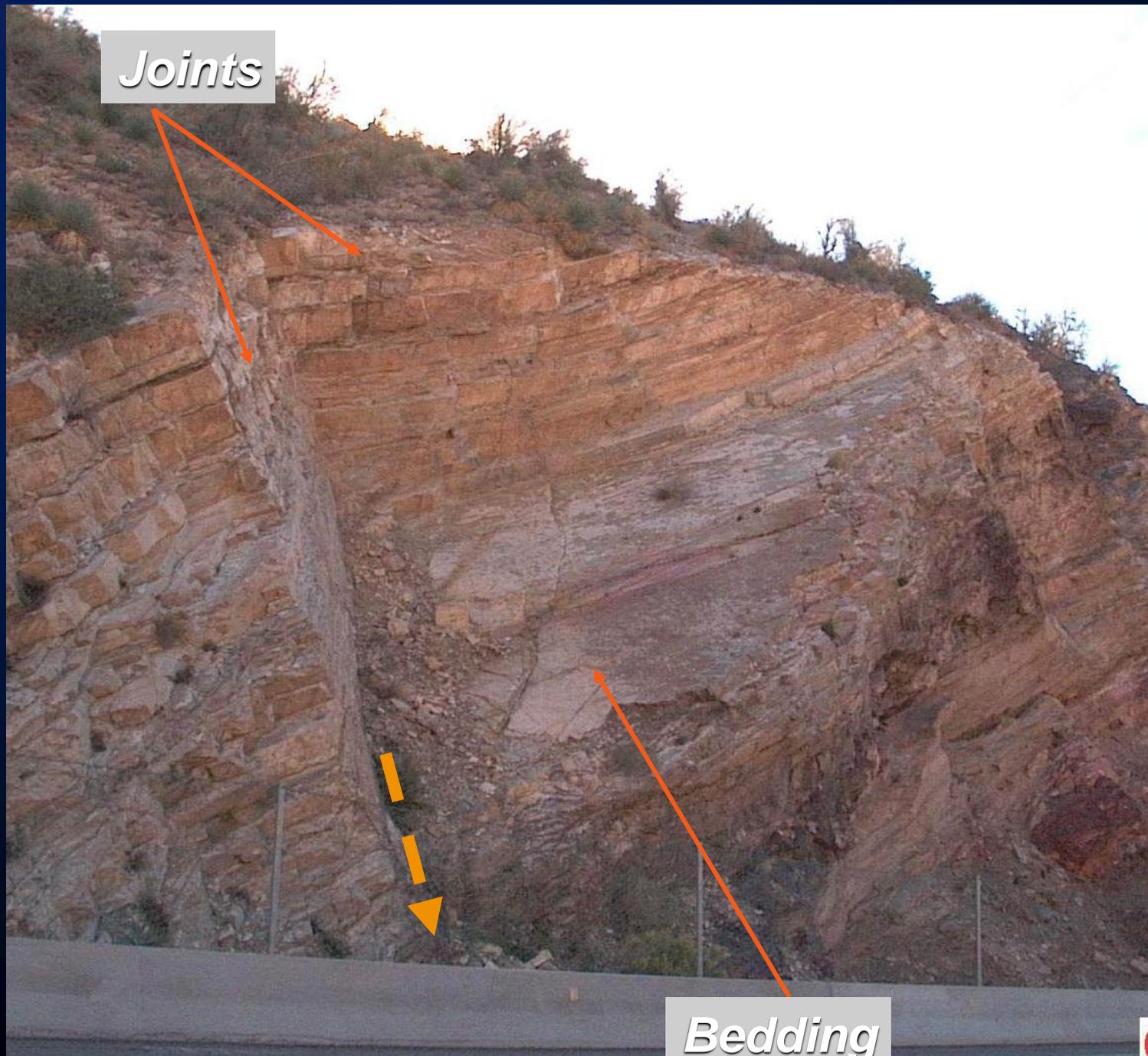
- ***Identify Geometric Conditions for Wedge Failure;***
- ***Analyze for Wedge Failure using Design Chart;***
- ***Apply Wedge Stability Conditions to Rock Slope Design for Highways.***



Wedge failure in very strong granite with widely spaced joints

(Upstate New York)

Joints



Bedding

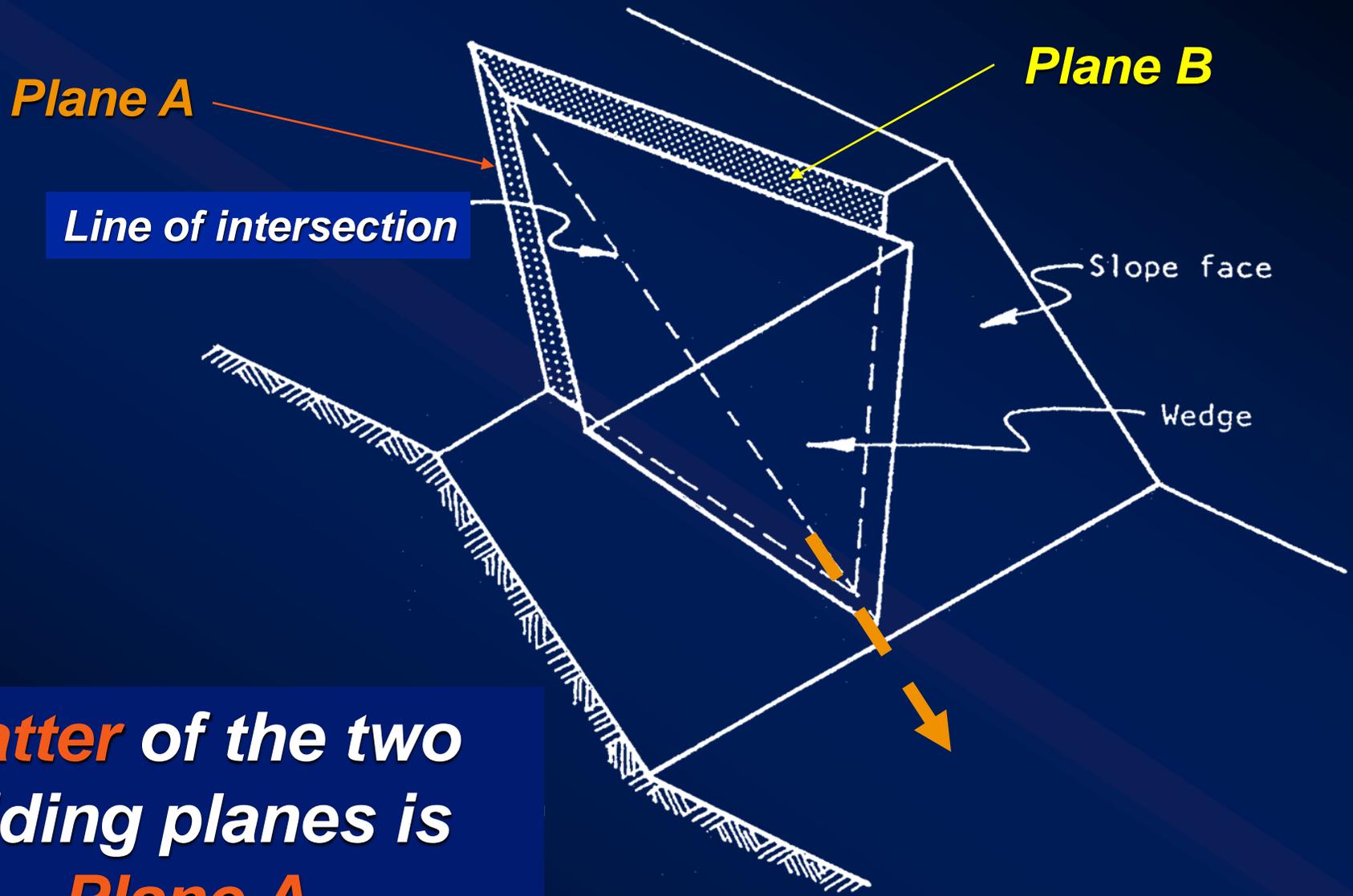
***Wedge formed by
bedding and
orthogonal joints
in sandstone***

(US60, Globe, AZ)

Conditions for Wedge Failure

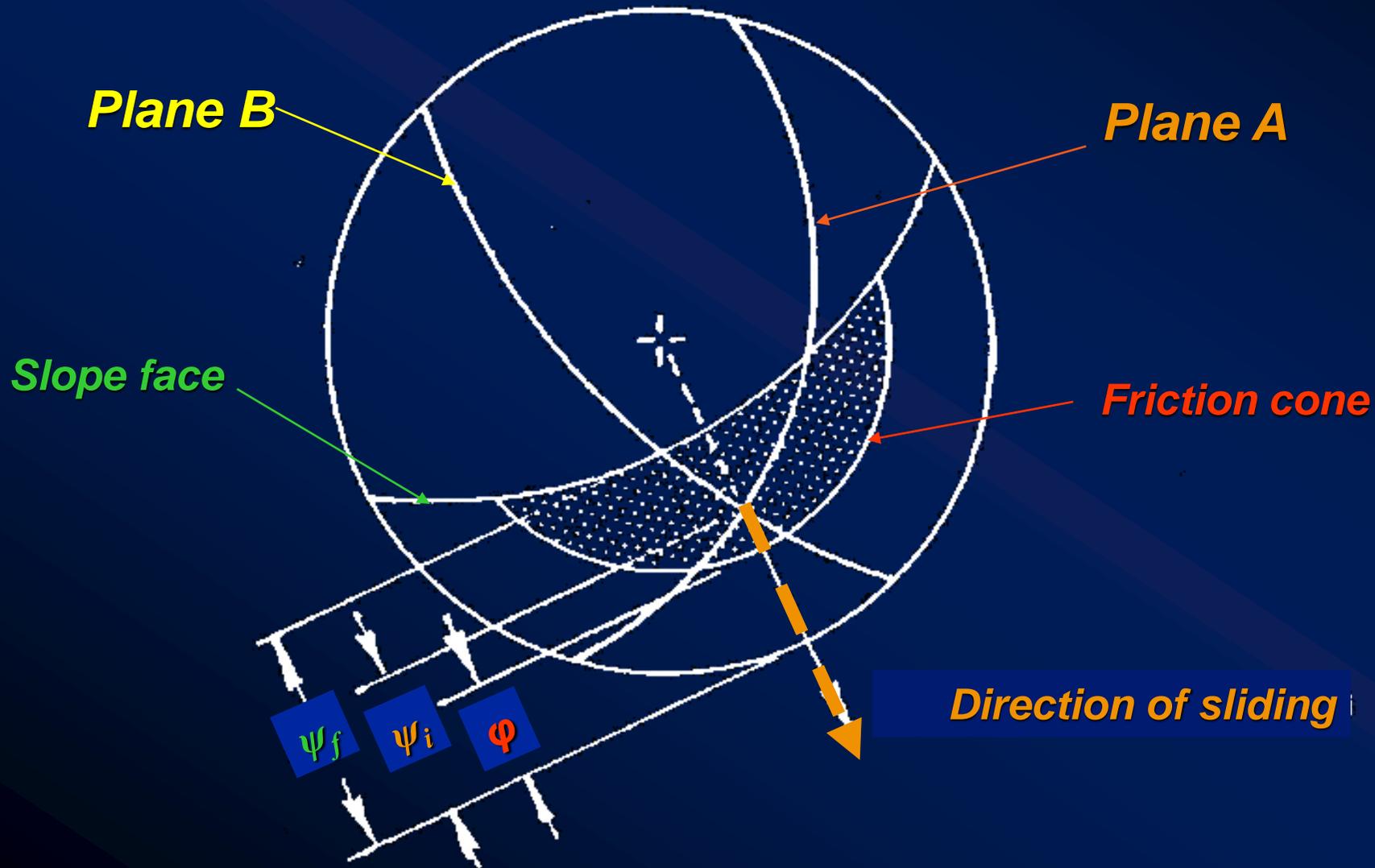
- ***Two Intersecting Planes Behind Face***
- ***Line of Intersection “Daylights” on Face***
- ***Line of Intersection Dips $> \phi$***

Wedge Failure Geometry



Flatter of the two
sliding planes is
Plane A

Stereoplot of Wedge Failure Geometry



Analysis of Wedge Failure

■ *Factor of Safety F , for Friction only*

$$F = \frac{\text{Resisting Force}}{\text{Displacing Forces}}$$

$$F = \frac{(R_A + R_B) \tan \phi}{W \sin \psi_i}$$

(6-1)

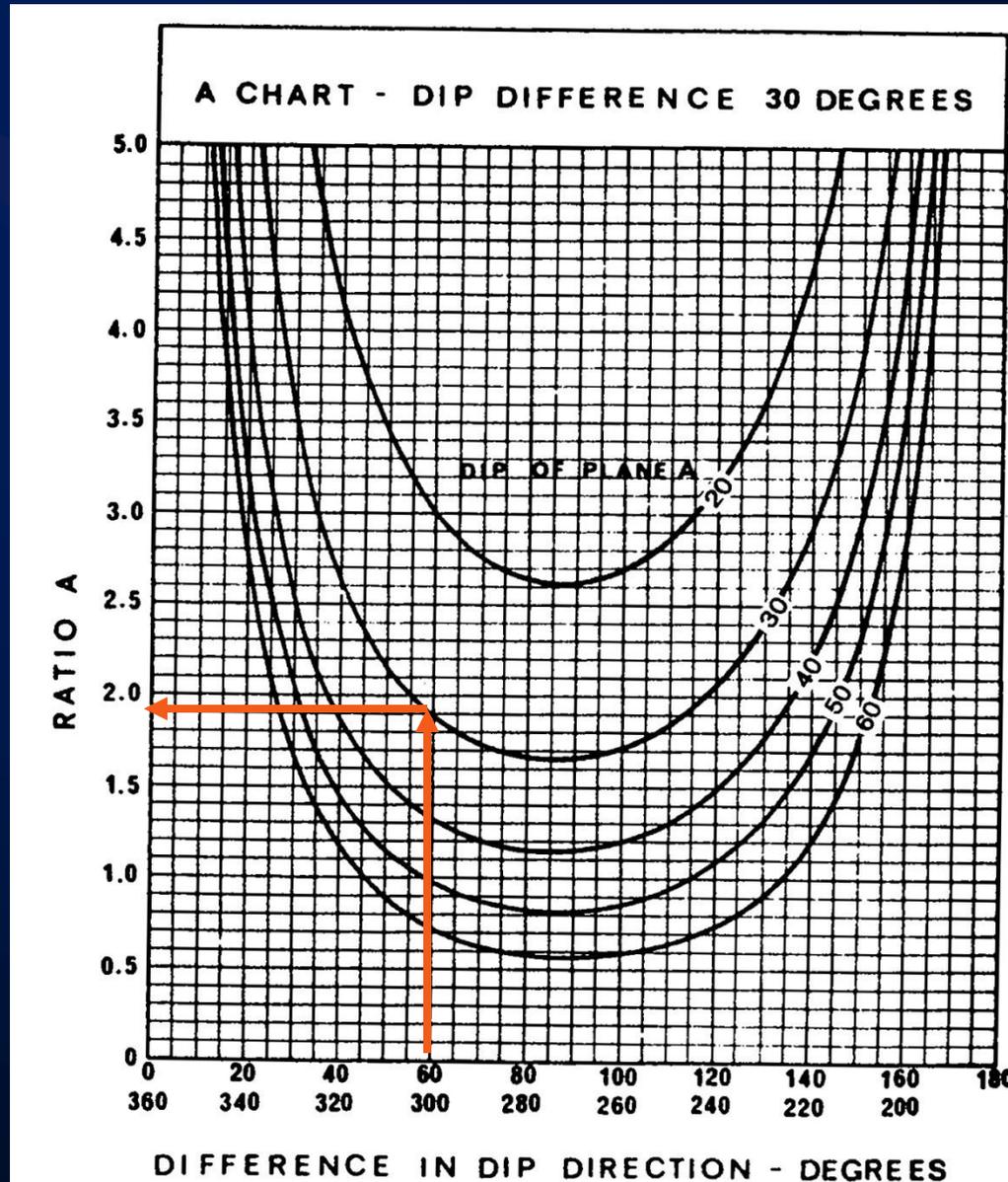
Wedge Stability Charts for Friction Only

■ *Factor of Safety*

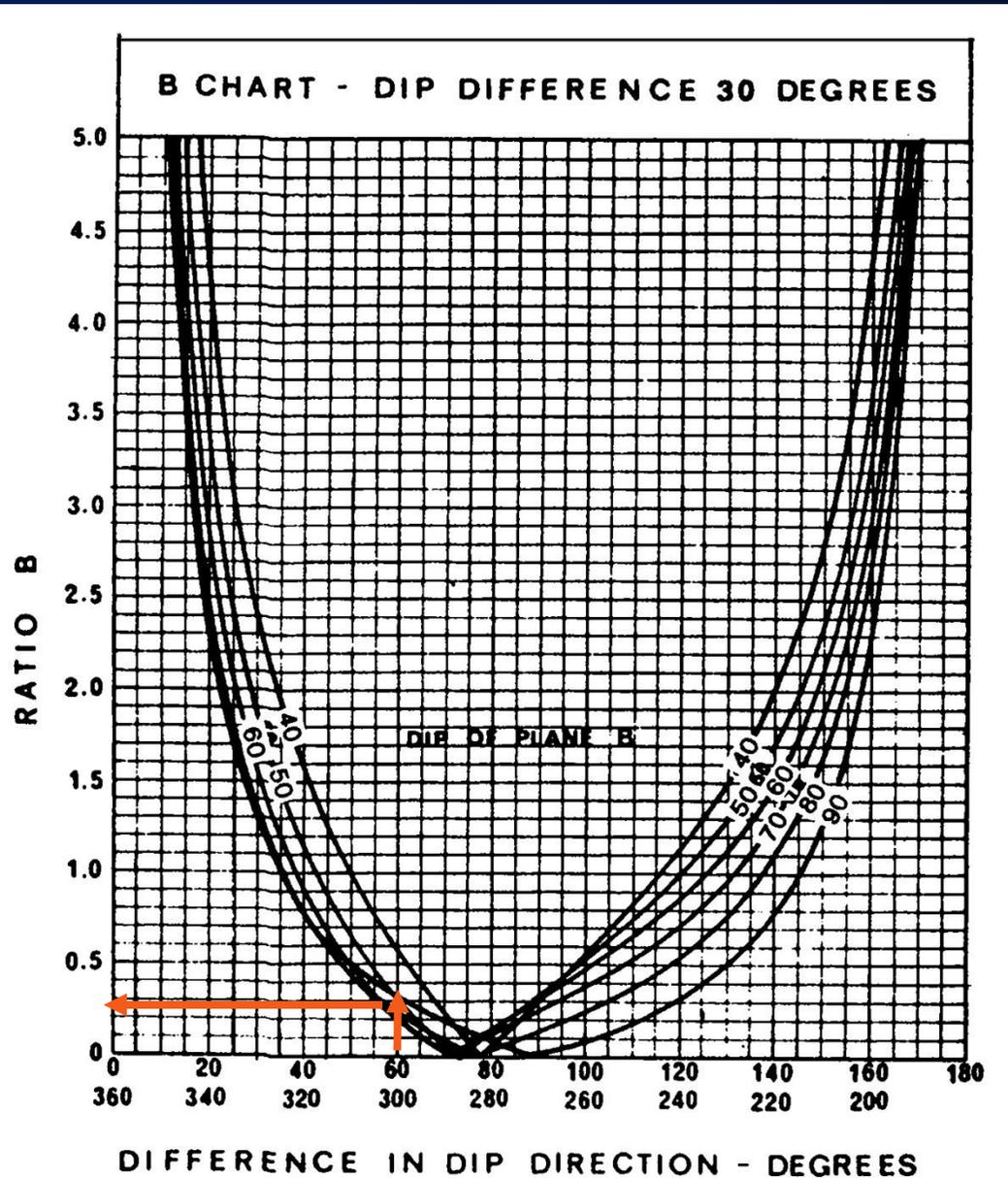
$$F = A \tan \phi_A + B \tan \phi_B$$

■ *Plane A is Flatter of Two Sliding Planes*

Wedge Stability Chart A

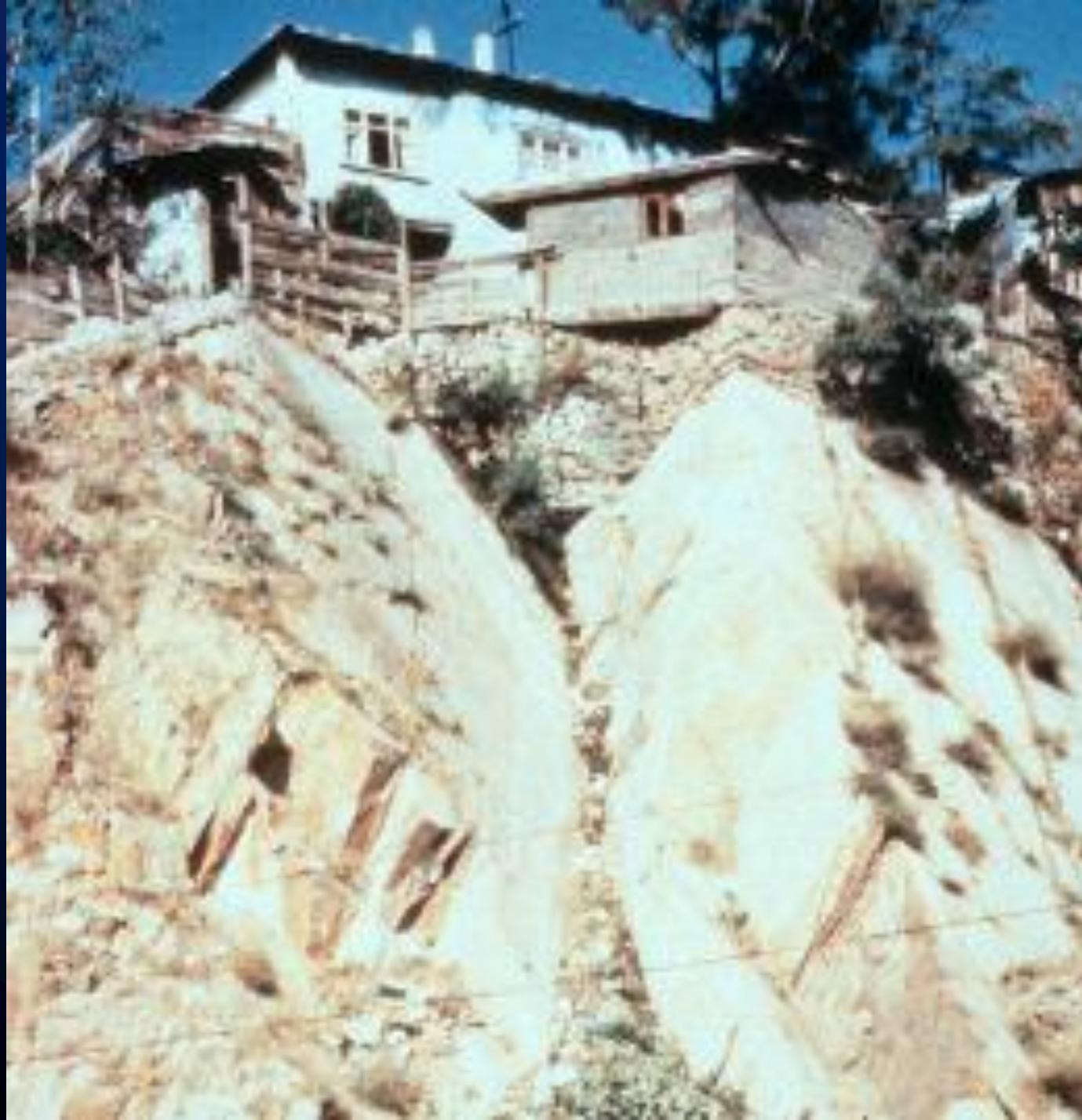


Wedge Stability Chart B



Student Exercise – Wedge Stability Analysis

Student Exercises No. 1B and No. 5



***Wedge failure in
sandstone with
orthogonal jointing***

(Ankara, Turkey)

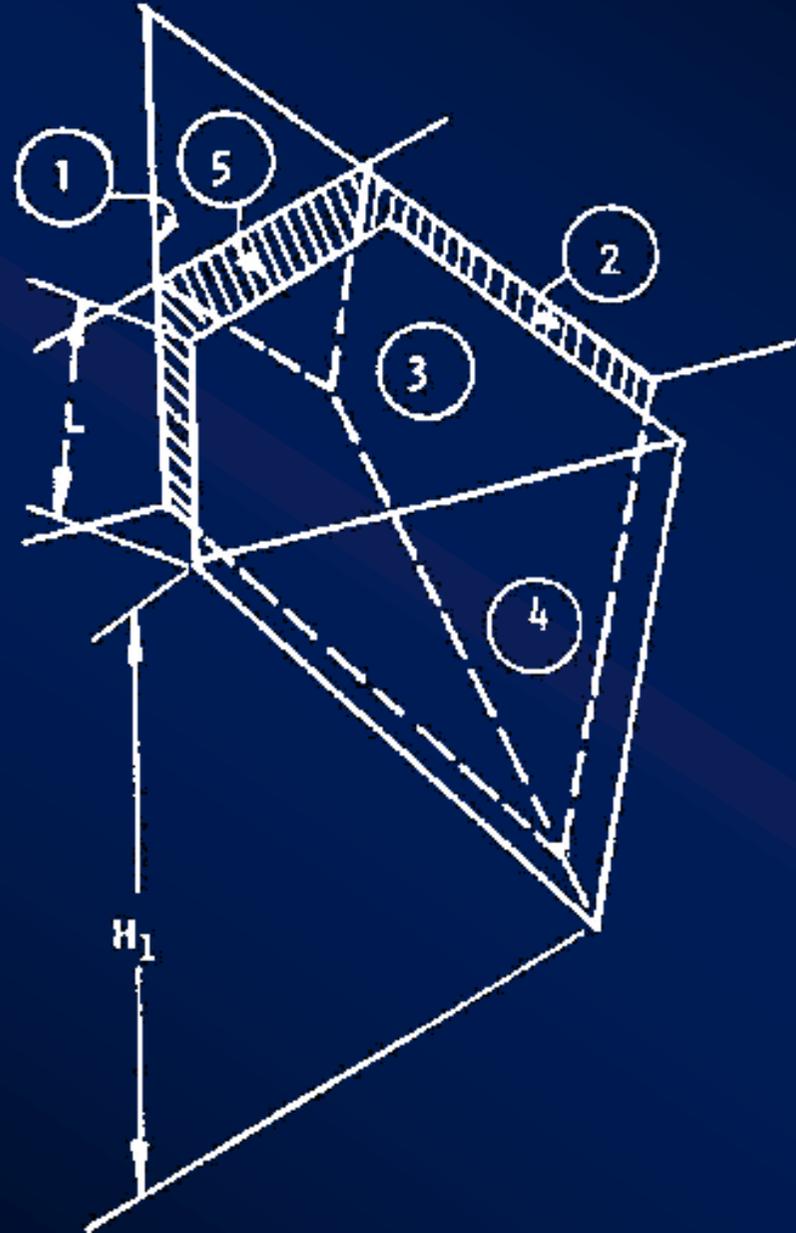


***Wedge failure in shale with orthogonal jointing; tension on right side
(Helena, MT)***

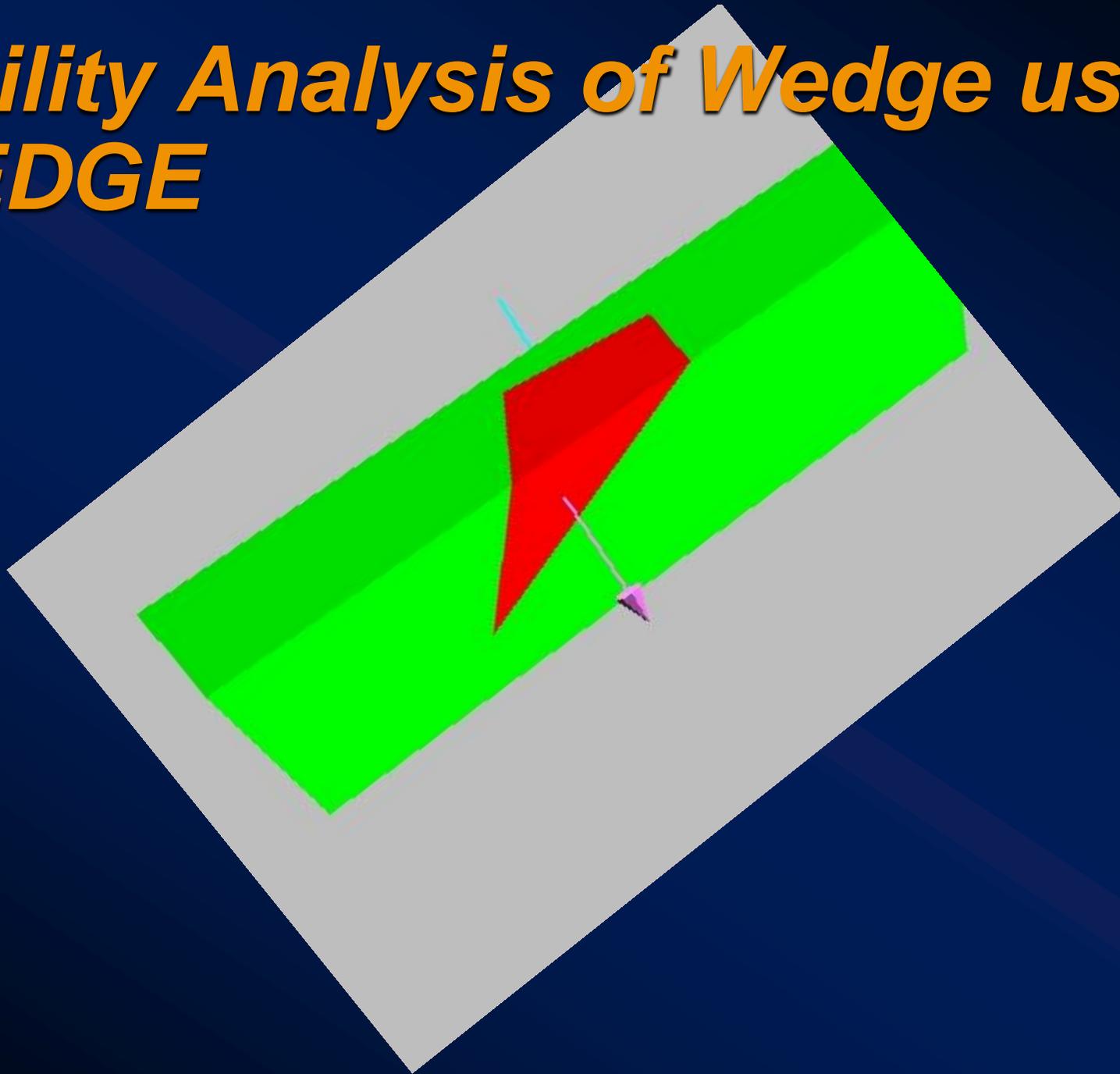


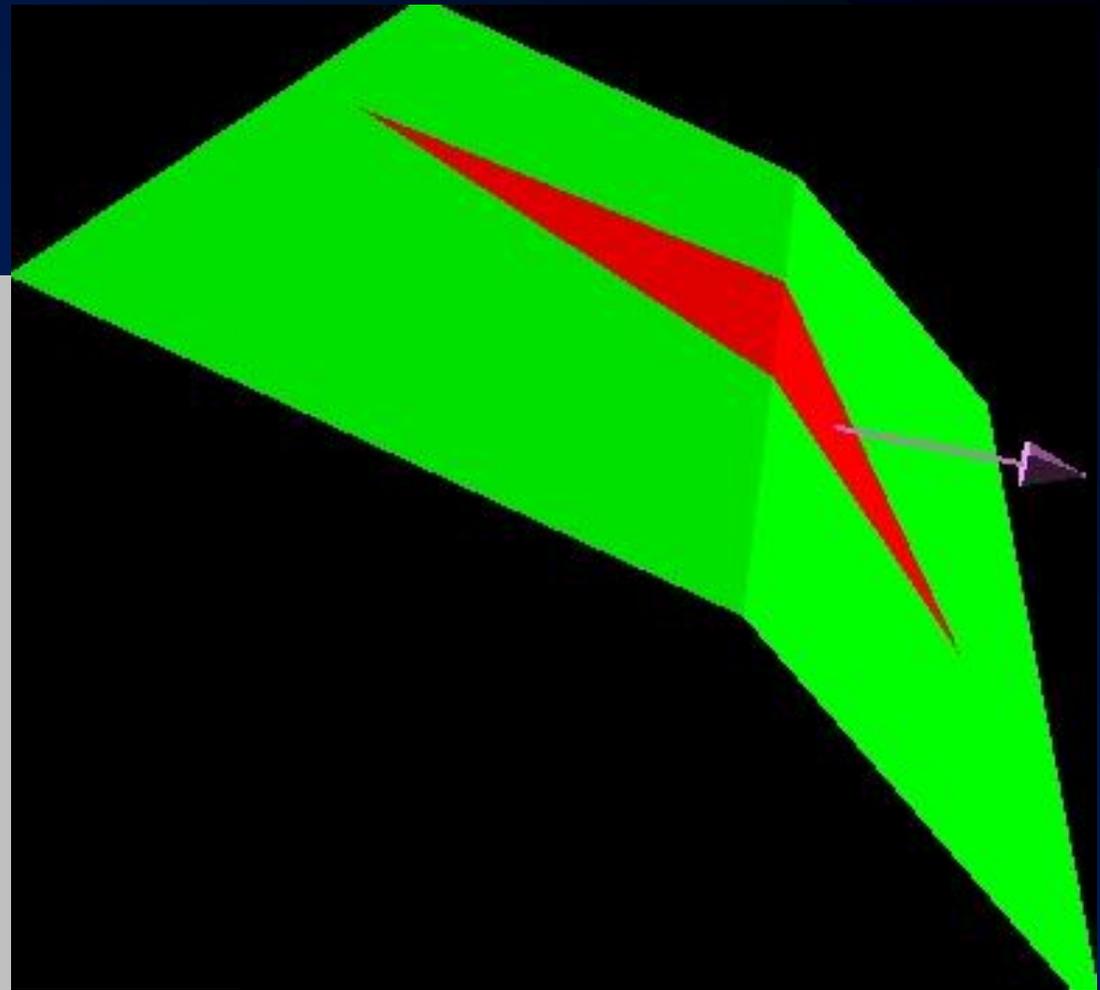
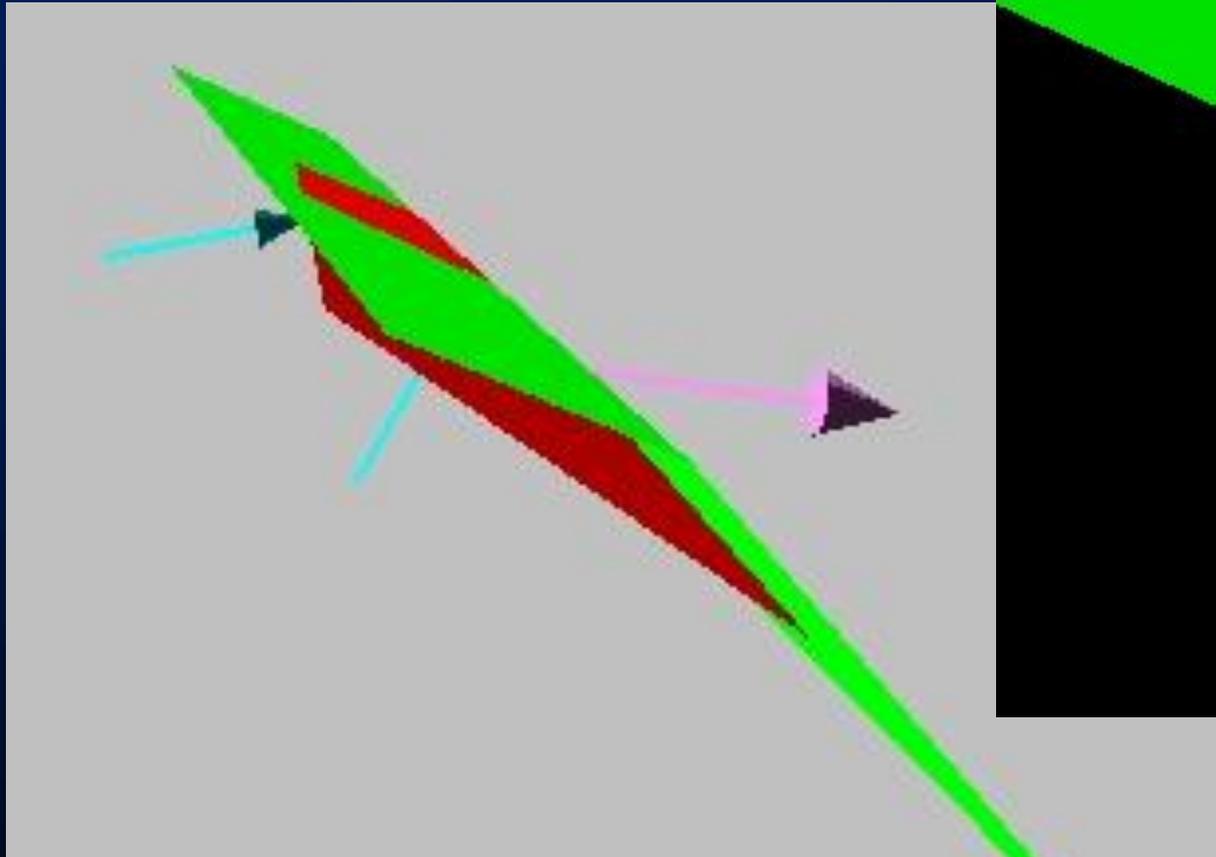
Potential wedges formed by discontinuous joints (US23, Flag Pond, TN)

Analysis of Wedge Failure

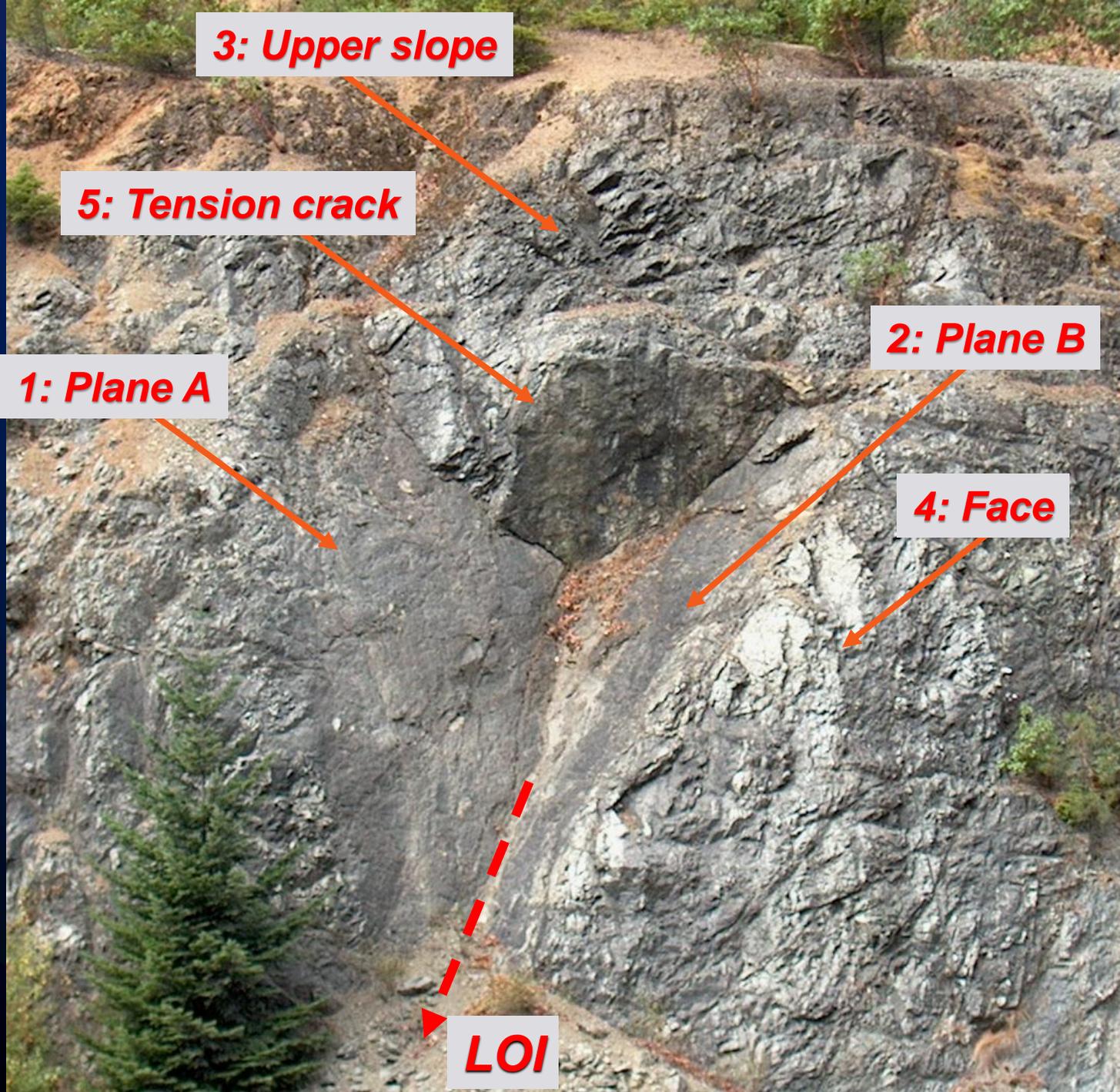


Stability Analysis of Wedge using SWEDGE





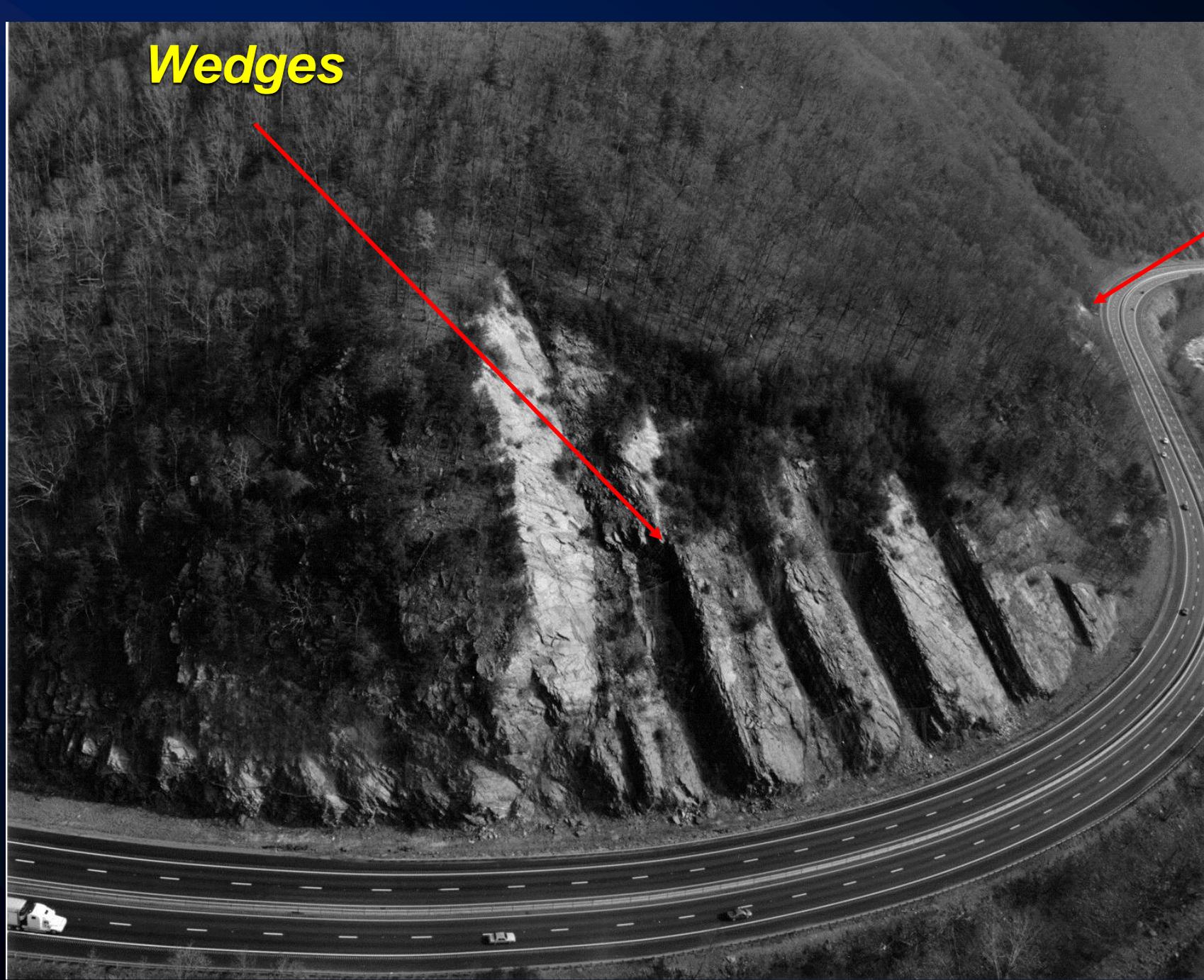
SWEDGE analysis showing wedge geometry (red), water forces (blue) and external force (purple).



**Wedge formed by
five planes
(1-5, Grants Pass, OR)**

Wedges

Planar slides





Plane failure on bedding



***Wedges formed
by bedding and
joints***

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