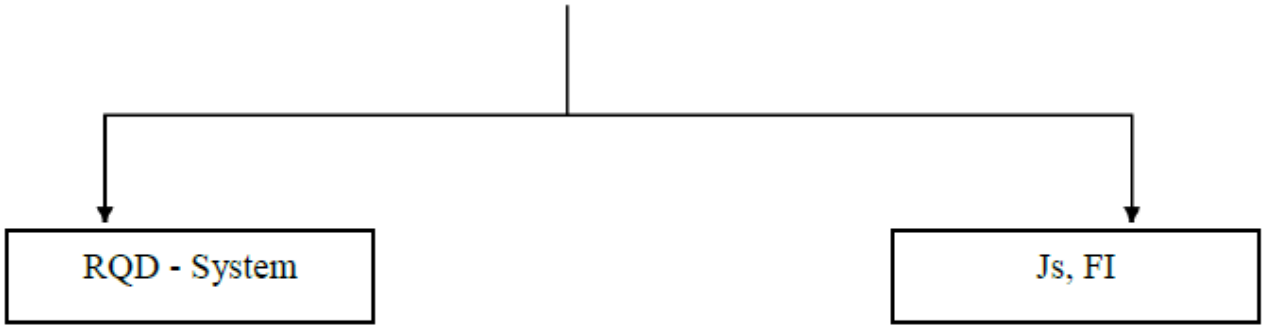
C.Classification Systems of Discontinuity Surfaces



Rock Quality Designation, RQD (1964)

Joint Spacing
(Fracture Intercept)

1- Joint Spacing, (Js) OR Fracture Intercept, (FI):

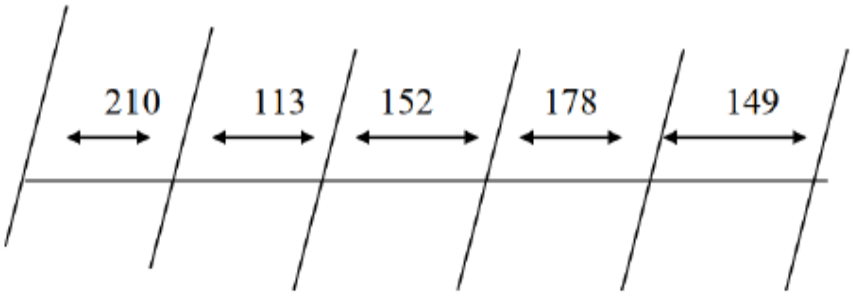
Joint System: nearly parallel system with approximately same distances between individual joints and nearly with the same dip amount and direction.

The practical method to compute **Js**, **FI** is **Scan-Line.**

Descriptive terms for joints spacing (After Geological Society of London, 1977)

Intervals (cm)	Symbols	Description
>200	F_1	Extremely wide spaced
60 – 200	F_2	Widely spaced
20 – 60	F_3	Moderately wide spaced
6 – 20	F_4	Closely spaced
2 – 6	F_5	Very closely spaced
< 2	F_6	Extremely closed spaced

Example:



There are two methods to compute **Joint Spacing**:

1- $Av.J.s = \frac{distance\ between\ joints}{number\ of\ specimens\ between\ joints}$

2- $Av.J.s = \frac{length\ of\ scan\ line}{number\ of\ \ joints}$

Solution:

First method:

$$Av.J.s = \frac{149+178+152+113+210}{5} = \frac{802}{5}$$

$$\therefore \text{Av. J.s} = 160.4 \text{ cm}$$

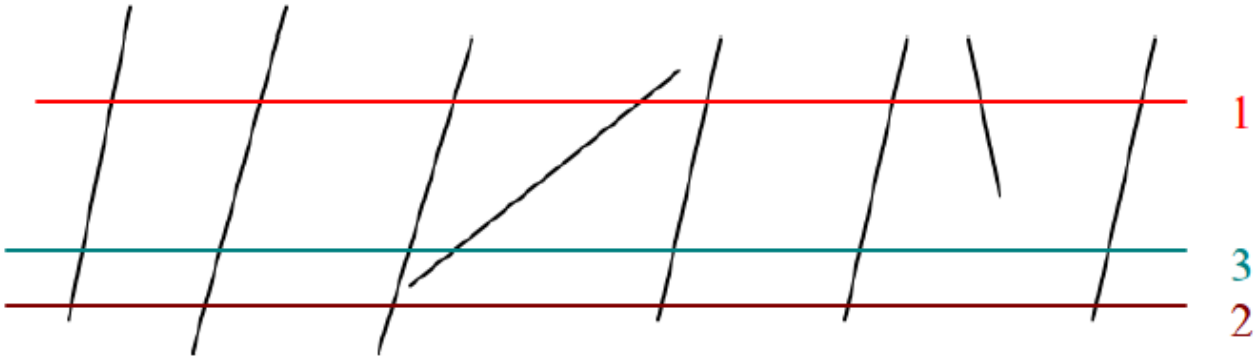
Second method:

$$Av.J.s = \frac{800}{5} = 160\ cm$$

Classification: according the previous table, these joints classified as Widely spaced (F_2).

Computing Fracture Intercept:

Compute Fracture Intercept for 8 meter if:



$$1.\ Av.FI = \frac{800}{8} = 100\ cm$$

$$2.\ Av.FI = \frac{800}{6} = 133.3\ cm$$

$$3.\ Av.FI = \frac{800}{7} = 114.3\ cm$$

$$\therefore Av.FI = \frac{100+133.3+114.3}{3} = 115.87\ cm$$

Classification: according the previous table, these joints classified as Widely spaced (F_2).

2- RQD-System

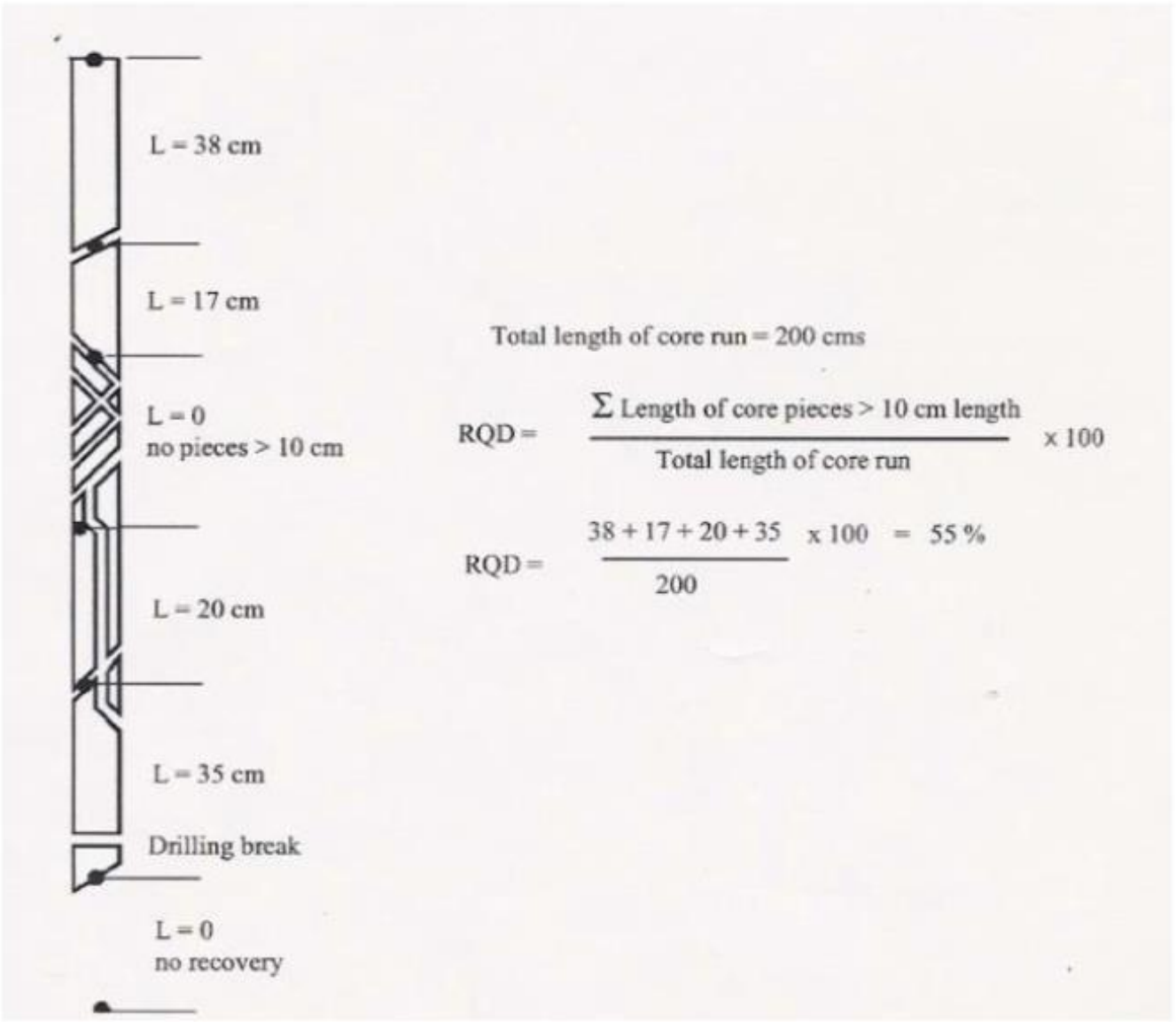
By Deere and Miller (1964)

2-1 Computing RQD value using the Formula below:

$$\boldsymbol{RQD}\ (\%) = \frac{\sum Samples \geq 10cm, \geq 4inch}{TotalRun}$$

Descriptive terms for Rock Quality Designation (After Deere and Miller, 1966)

Descriptive Term	RQD %	Symbols
Very Good	90 – 100	R_1
Good	75 – 90	R_2
Fair	50 – 75	R_3
Poor	25 – 50	R_4
Very Poor	<25	R_5



Example:

Total Run 300 cm

Total Sum of solid samples:

18, 32, 8, 22, 54, 10, 9, 4, 40, 14, 50, 26, 12 cm = 299 cm

$$\therefore Tcr = \frac{299}{300} * 100 = 99.7\%$$

$$RQD = \frac{278}{300} * 100 = 93\%$$

2-2 At mountainous areas, **Palmstrom (1982)** introduced the equation below to compute **RQD**:

$$\boldsymbol{RQD = 115 - 3.3 * (J_v)}$$

J_v (Volumetric Joints) = No. of Joints in $1m^3$

Table Block size expressed in terms of J_v (Joints/m^3) (After Barton, 1978)

J_v (Joints/m^3)	Descriptive Terms
< 1	Very Large Blocks
1-3	Large Blocks
3-10	Medium-sized Blocks
10-30	Small Blocks
> 30	Very Small Blocks

Example:

Calculate **RQD** value for 12 joints in a sector of 4 m length.

$RQD = 115 - 3.3 (J_v)$

Face 1 = 12 Joints/4m = 3 Joints/1m

Face 2 = 3 Joints/1m

Face 3 = 3 Joints/ 1m

$\therefore J_v = 3+3+3 = 9$ Joints/ $1m^3$

RQD = 115 –3.3 (9)

RQD = 115 – 29.7

RQD = 85 %

Class: (R2) Good Quality

RQD calculation from Joint Spacing, (J_s) & Fracture Intercept, (FI)

Example:

Calculate RQD value with classification for all the following data:

The first face of Granitic rock masses:

First face: 25 joints in 5m

Second face: **J. S** = 25cm

Third face: **FI** = 20cm

Solution:

$RQD = 115 - 3.3\ (J_v)$

∴ Face 1 = 25 Joints/ 5m = 5 Joints/1m

Face 2 = 25 cm ⟹ 4 Joints/ 1m

Face 3 = 20 cm ⟹ 5 Joints/ 1m

∴ J_v= 5+4+5 = 14 Joints/1m³

RQD = 115 – 3.3 (14) = 69 %

The rock mass of Granite has a **fair quality (R3)** according to **RQD** system by Palmstrom (1982) and the fracture is **moderately wide to closely spaced (F3 – F4)** according to Geological Society (1977) and has a **small blocks** based on **Jv system** according to Barton (1978).