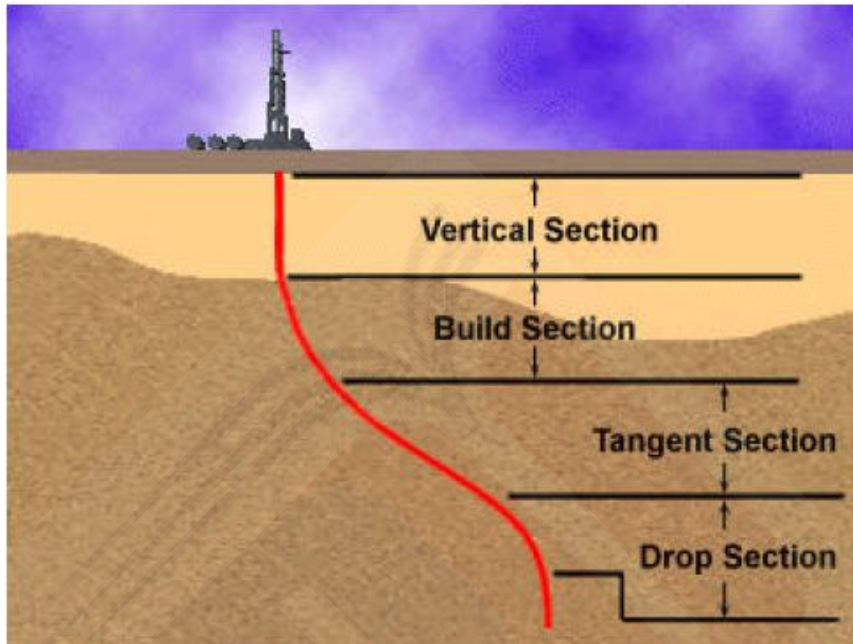


المحاضرة العاشرة تصميم البروفيل الثاني

3-5-5. حساب البروفيل من النوع (S)



المعلومات المعطاة:

Target location = 3500 ft @ 235° AZM .

Target's TVD (V4) = 12,000 ft .

KOP (V1) = 6084 ft .

Build up rate (BUR) = 3° / 100 ft .

Drop off rate (DOR) = 2° / 100 ft

المجاهيل المطلوب ايجادها:

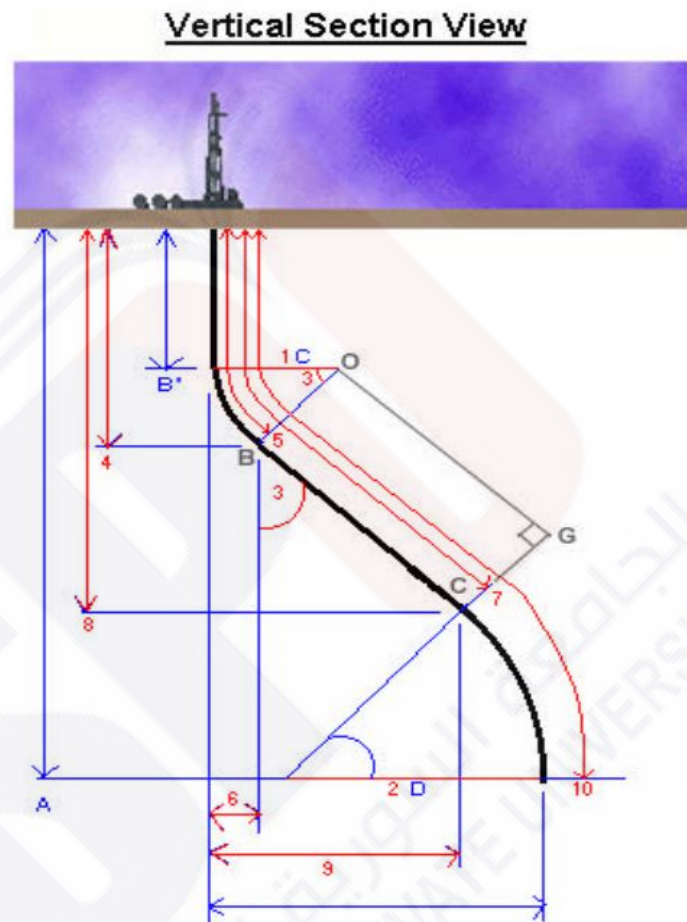
1. Profile drawing .
2. Well coordinate .
3. Build and drop radius .
4. MAX hold angle
5. EOB TVD .
6. EOB MD .
7. EOB displacement .

8.Start of drop (SOD) MD .

9.SOD TVD .

10 .SOD displacement, and .

11.Total MD to the target .



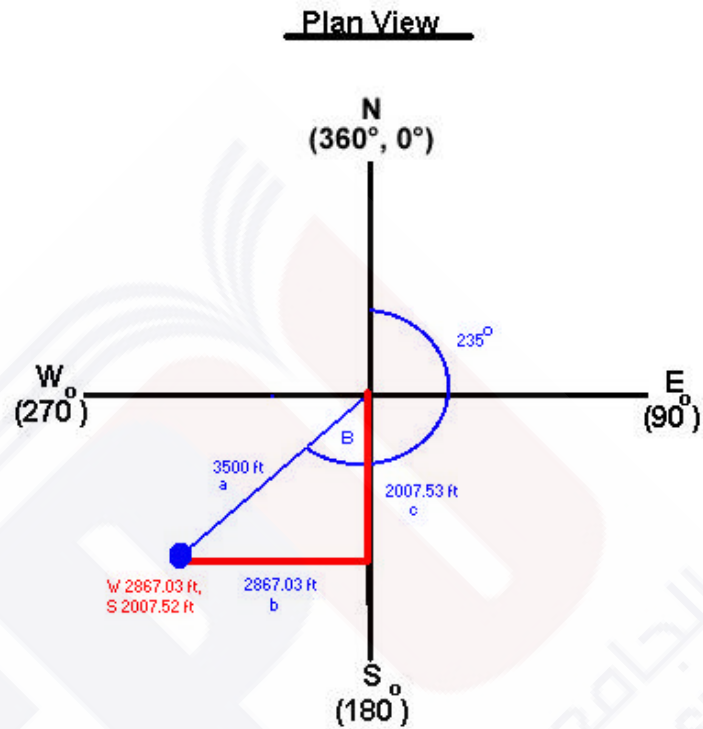
1. مخطط البروفيل: يبين شكل البروفيل والقوانين الخاصة بحساب المساقط الشاقولية والأفقية للمجالات والمساقط و زوايا الانحراف وشدة الانحراف

"S" - Type Well Profile Worksheet

Plan View		Given Information	
		Target Location	3500 ft @ 235 AZM
		KOP (V ₁)	6084 ft
		Target TVD (V ₄)	12,000 ft
		BUR	3°
		DOR	2°
Unknown Profile Variables			
Variables		Answer	
Coordinate			
R ₁ & R ₂		R ₁ = R ₂ =	
MAX Hold Angle (Θ)			
EOB TVD (V ₂)			
EOB MD			
EOB Displacement(D ₁)			
SOD MD (V ₃)			
SOD TVD			
SOD Displacement(D ₂)			
Total MD to Target			
Formula		Answer	
Coordinate			
W Distance: b = sin <B x a		b =	
S Distance: c = cos <B x a		c =	
Build & Drop Radius			
R ₁ = 5729.58 / BUR		R ₁ =	
R ₂ = 5729.58 / DOR		R ₂ =	
MAX Hold Angle (Θ)			
FE = R ₁ - (D ₃ - R ₂)		FE =	
EO = V ₄ - V ₁		EO =	
FOE = tan ⁻¹ (FE/EO)		FOE =	
OF = √(FE ² - EO ²)		OF =	
FG = R ₁ + R ₂		FG =	
FOG = sin ⁻¹ (FG/OF)		FOG =	
Θ = FOG - FOE		Θ =	
EOB TVD (V ₂)			
V ₂ = V ₁ + R ₁ x sin Θ		V ₂ =	
EOB MD			
EOB MD = V ₁ + $\frac{\Theta}{BUR} \times 100$		EOB MD =	
EOB Displacement (D ₁)			
D ₁ = R ₁ - (R ₁ x cos Θ)		D ₁ =	
SOD MD, SOD TVD, SOD D ₂			
OG = √(OF ² - FG ²)		OG =	
SOD MD = V ₁ + $\frac{\Theta}{BUR} \times 100$ + BC		SOD MD =	
V ₃ = V ₂ + (BC x cos Θ)		V ₃ =	
D ₂ = D ₁ + (BC x sin Θ)		D ₂ =	
Total MD to Target			
Total MD = V ₁ + $\frac{\Theta}{BUR} \times 100$ + BC + $\frac{\Theta}{DOR}$		Total MD =	
Vertical Section View			

2. حساب العناصر المحددة للوضع الفراغي للبئر:

1-2. تحديد زاوية السميت والانزياح الافقي لقعر البئر عن الشاقول:



○ Formula: $\sin \angle B = \frac{b}{a}$

- $b = \sin \angle B \times a$
- $b = \sin 55^\circ \times 3500$
- $b = 0.8192 \times 3500$
- $b = 2867.03 \text{ ft}$
- Answer for the west distance = 2867.03 ft

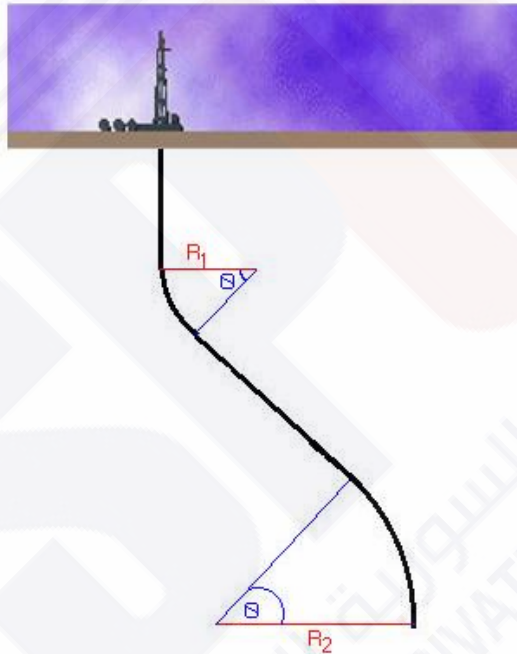
○ Formula: $\cos \angle B = \frac{c}{a}$

- $c = \cos \angle B \times a$
- $c = \cos 55^\circ \times 3500$
- $c = 0.573576 \times 3500$
- $c = 2007.52 \text{ ft}$
- Answer for the south distance = 2007.52 ft

2-2. حساب نصف قطر الانحراف للمجالين:

Calculating Build and Drop Radius

Vertical Section View



○ Formula: Build radius (R_1) = $\frac{180}{\pi} \times 100 \times \frac{BUR}{BUR}$ or $R_1 = \frac{5729.58}{BUR}$

• $R_1 = \frac{5729.58}{BUR}$

• $R_1 = \frac{5729.58}{3^\circ}$

• $R_1 = 1909.86$

- Answer for the build radius (R_1) = 1909.86 ft

○ Formula: Drop radius (R_2) = $\frac{180}{\pi} \times 100$ or $R_2 = \frac{5729.58}{DOR}$

• $R_2 = \frac{5729.58}{DOR}$

• $R_2 = \frac{5729.58}{2^\circ}$

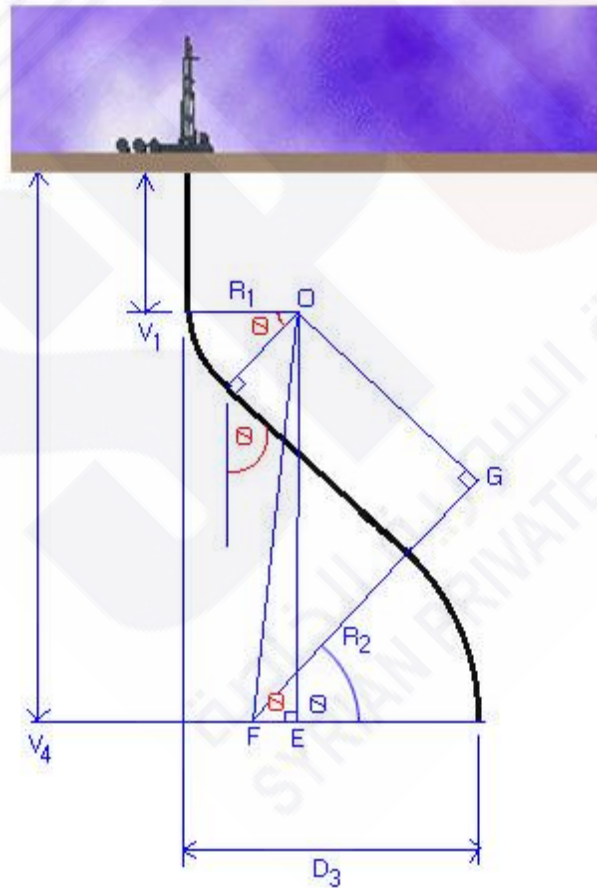
• $R_2 = 2864.79$

• Answer for the drop radius (R_2) = 2864.79 ft

2-3. حساب زاوية الميل العظمى:

Calculating MAX HoldAngle

Vertical Section View



- First, find line $FE = R_1 - (D_3 - R_2)$
- Second, find line $EO = V_4 - V_1$
- Third, find angle $\angle FOE = \tan^{-1} \frac{FE}{EO}$
- Fourth, find line $OF = \sqrt{FE^2 + EO^2}$
- Fifth, find line $FG = R_1 + R_2$
- Sixth, find angle $\angle FOG = \sin^{-1} \frac{FG}{OF}$
- Seventh, find the MAX hold angle (θ or $\angle EOG$) $= \angle FOG - \angle FOE$

○ Formula: $FE = R_1 - (D_3 - R_2)$

- $FE = 1909.86 - (3500 - 2864.79)$
- $FE = 1909.86 - (635.21)$
- $FE = 1274.65 \text{ ft}$

(This answer will be used with the third and fourth steps.)

○ Formula: $EO = V_4 - V_1$

- $EO = 12,000 - 6,084$
- $EO = 5916 \text{ ft}$

(This answer will be used with the third and fourth steps.)

○ Formula: $\tan \angle FOE = \frac{FE}{EO}$

- $\angle FOE = \tan^{-1} \frac{FE}{EO}$
- $\angle FOE = \tan^{-1} \frac{1274.65}{5916}$
- $\angle FOE = \tan^{-1} 0.2155$
- $\angle FOE = 12.16^\circ$

(This answer will be used with the seventh step.)

○ Formula: $OF^2 = FE^2 + EO^2$

• $OF = \sqrt{FE^2 + EO^2}$

• $OF = \sqrt{1,274.65^2 + 5,916^2}$

• $OF = \sqrt{36,623,788}$

• $OF = 6,051.76 \text{ ft}$

(This answer will be used with the sixth step.)

○ Formula: $FG = R_1 + R_2$

• $FG = 1,909.86 + 2,864.79$

• $FG = 4775.65$

(This answer will be used with the sixth step.)

○ Formula: $\sin \angle FOG = \frac{FG}{OF}$

• $\angle FOG = \sin^{-1} \frac{FG}{OF}$

• $\angle FOG = \sin^{-1} \frac{4775.65}{6051.76}$

• $\angle FOG = \sin^{-1} 0.7891$

• $\angle FOG = 52.10^\circ$

(This answer will be used with the seventh step.)

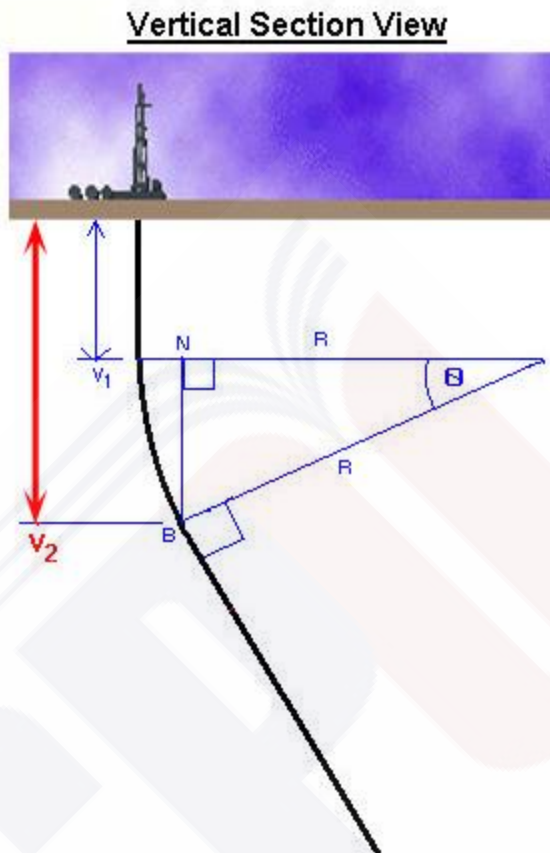
○ Formula: $\text{MAX hold angle } (\theta \text{ or EOG}) = FOG - FOE$

• $\text{MAX hold angle } (\theta) = 52.10^\circ - 12.16^\circ$

• $\text{MAX hold angle } (\theta) = 39.94^\circ$

4-2. حساب نهاية مجال بناء الزاوية العمق الشاقولي الحقيقي :

Calculating End of Build (EOB) True Vertical Depth (TVD)



○ Formula: EOB TVD (V_2) = $V_1 + [R_1 \times (\sin \theta)]$

- $V_2 = 6084 + [1909.86 \times (\sin 39.94^\circ)]$

- $V_2 = 6084 + [1909.86 \times (0.641985)]$

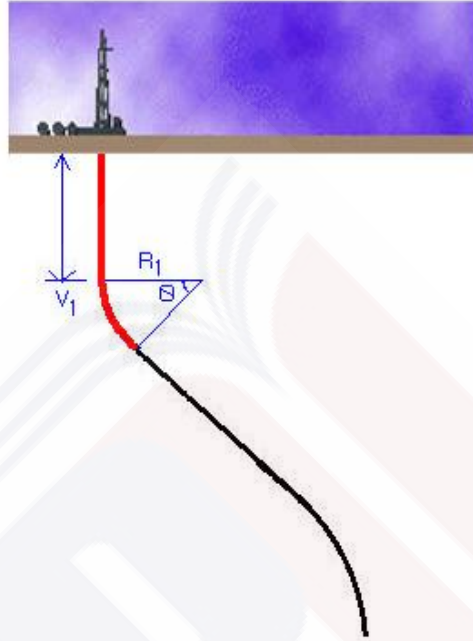
- $V_2 = 6084 + [1226.10]$

- $V_2 = 7310.10 \text{ ft}$

5-2. حساب نهاية مجال بناء الزاوية العمق المقاس:

Calculating End of Build (EOB) Measured Depth (MD)

Vertical Section View



○ Formula: $EOBMD = V_1 + \frac{\theta}{BUR} \times 100$

• $EOB MD = 6084 + \frac{39.94^\circ}{3^\circ} \times 100$

• $EOB MD = 6084 + (13.3133 \times 100)$

• $EOB MD = 6084 + (1331.33)$

• $EOB MD = 7415.33 \text{ ft}$

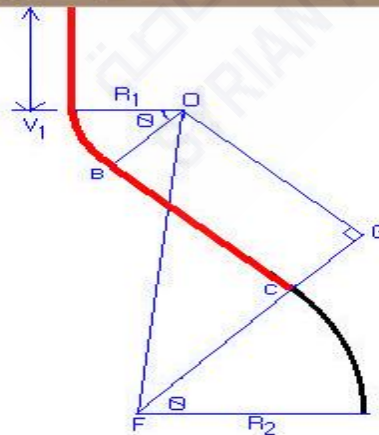
6-2. حساب الانزياح الأفقي للمجال المائل:

Calculating End of Build (EOB) Displacement



- $D_1 = 1909.86 - [1909.86 \times (0.766717)]$

- $D_1 = 445.54 \text{ ft}$



○ Formula: $OF^2 = OG^2 + FG^2$

- $OG = \sqrt{OF^2 - FG^2}$

- $OG = \sqrt{6,051.76^2 - 4,775.65^2}$

- $OG = \sqrt{13,816,966}$

- $OG (BC) = 3,717.12 \text{ ft}$

(This answer will be used in the second step as well as in calculating the SOD TVD and D_2 .)

○ Formula: $SOD \text{ MD} = V_1 + \frac{\theta}{BUR} \times 100 + BC$

- $SOD \text{ MD} = 6,084 + \frac{39.94^\circ}{3^\circ} \times 100 + 3,717.12$

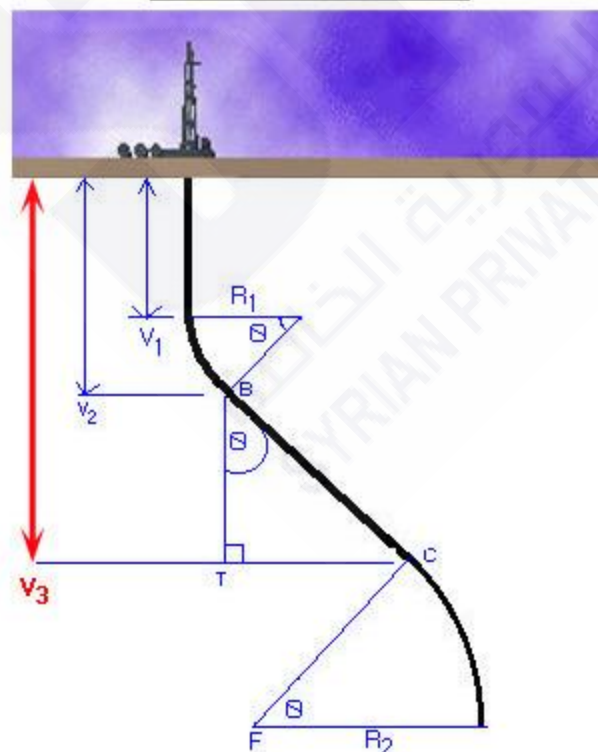
- $SOD \text{ MD} = 6,084 + (13.3133 \times 100) + 3,717.12$

- $SOD \text{ MD} = 6,084 + (1,331.33) + 3,717.12$

- $SOD \text{ MD} = 11,132.45 \text{ ft}$

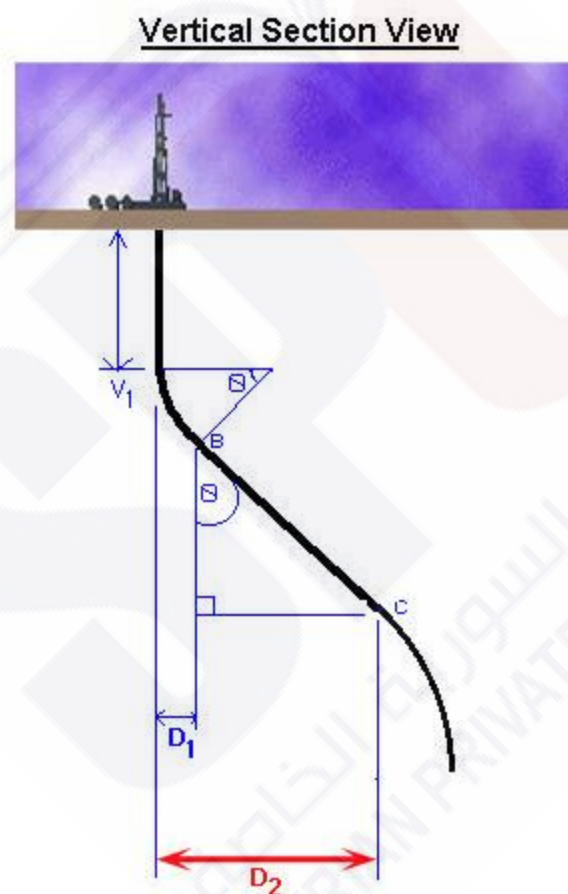
Calculating Start of Drop (SOD) True Vertical Depth (TVD).8-2

Vertical Section View



- Formula: SOD TVD (V_3) = $V_2 + [BC \times (\cos \theta)]$
 - $V_3 = 7,310.10 + [3,717.12 \times (\cos 39.94^\circ)]$
 - $V_3 = 7,310.10 + [3,717.12 \times (0.766717)]$
 - $V_3 = 7,310.10 + [2,849.98]$
 - $V_3 = 10,160.08 \text{ ft}$

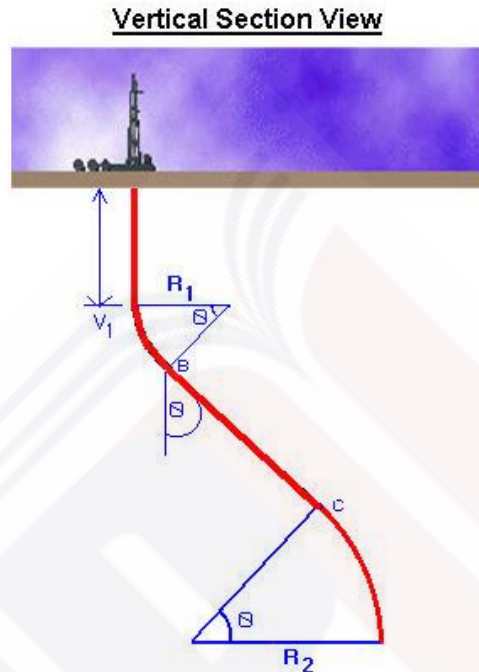
4.10 Calculating Start of Drop (SOD) Displacement^{9.-2}



- Formula: SOD displacement (D_2) = $D_1 + [BC \times (\sin \theta)]$
 - $D_2 = 445.54 + [3717.12 \times (\sin 39.94^\circ)]$
 - $D_2 = 445.54 + [3717.12 \times (0.641985)]$
 - $D_2 = 445.54 + [2386.34]$
 - $D_2 = 2831.88 \text{ ft}$

10-2. حساب العمق الكلي حتى الوصول للهدف

Calculating Total Measured Depth to the Target



○ Formula: Total measured depth = $V_1 + \frac{\theta}{BUR} \times 100 + BC + \frac{\theta}{BUR} \times 100$

- Total measured depth = $6,084 + \frac{39.94^\circ}{3^\circ} \times 100 + 3,717.12 + \frac{39.94^\circ}{2^\circ} \times 100$

- Total measured depth = $6,084 + (13.3133 \times 100) + 3,717.12 + (19.97 \times 100)$

- Total measured depth = $6,084 + (1,331.33) + 3,717.12 + (1,997)$

- Total measured depth = 13,129.45 ft