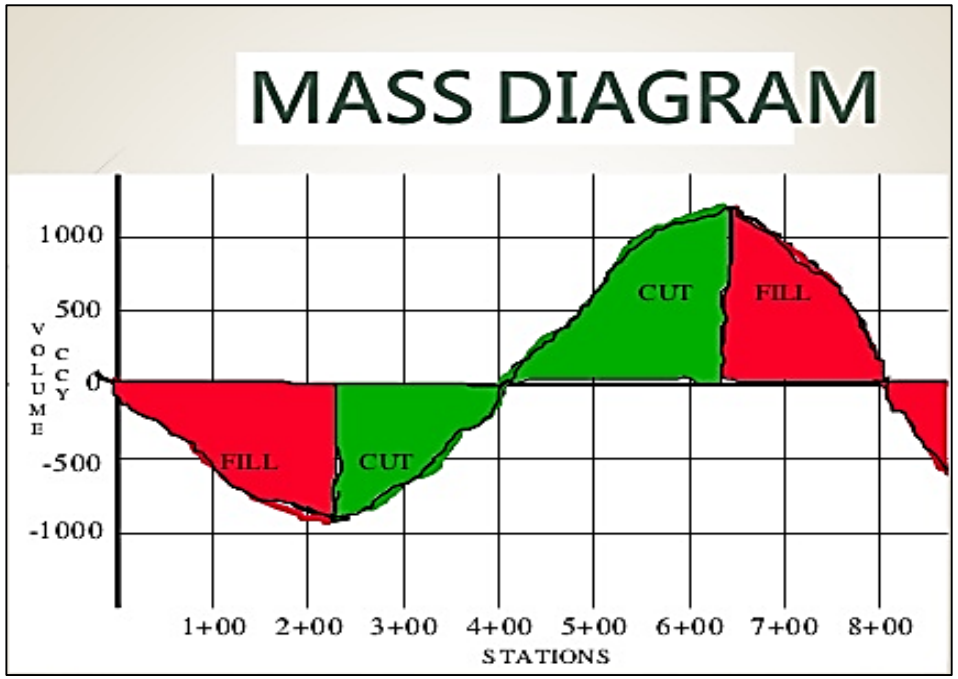
Republic of Iraq
Ministry of Higher Education & Scientific Research
Al-Mustaqbal University College
Department of Building & Construction Engineering

"TRANSPORTATION ENGINEERING" 3rd Stage

((Earthworks & Mass-Haul Diagram الاعمال الترابية))

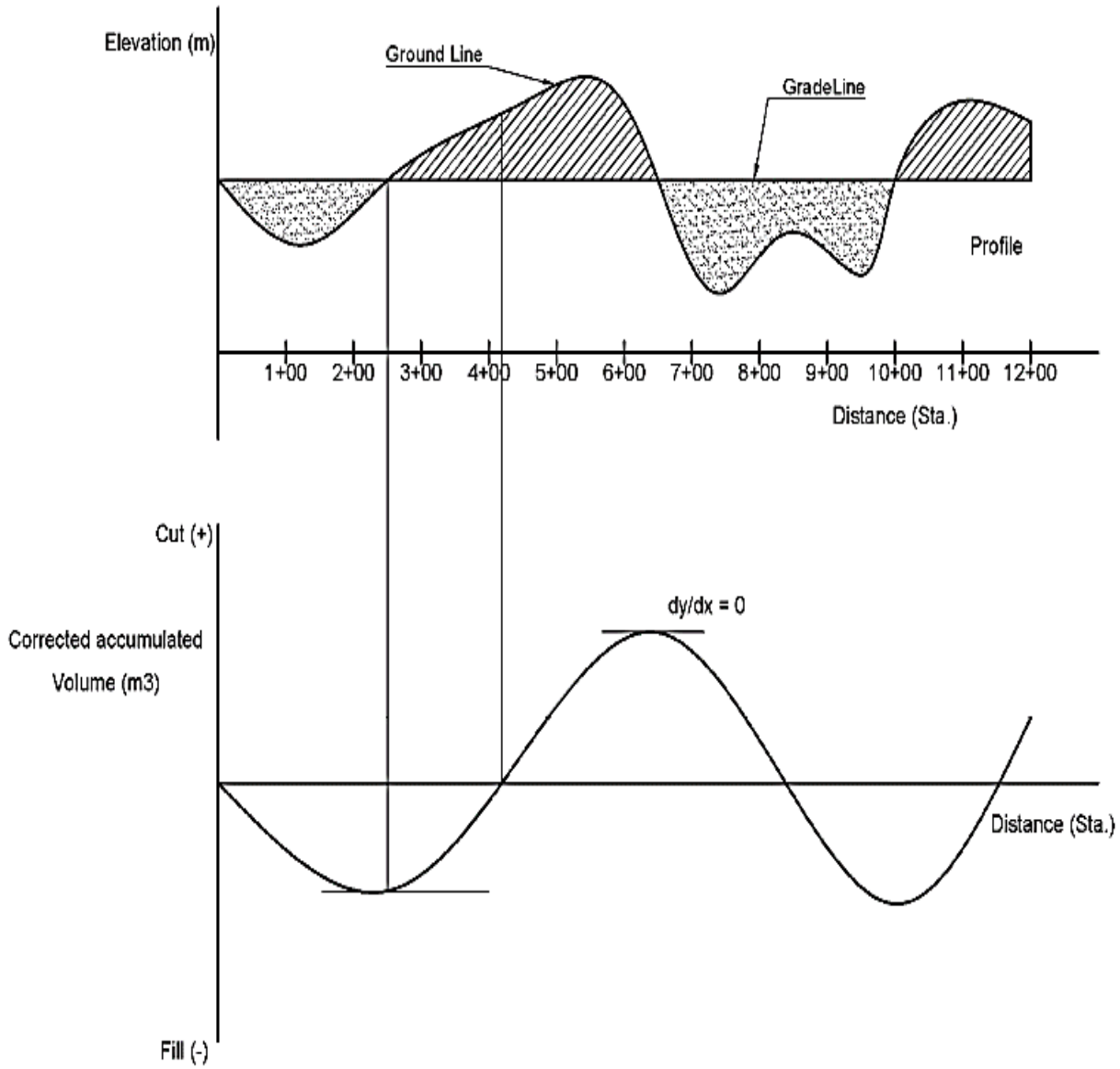


Prepared by The Senior Lecturer: Mr. Tameem Mohammed Al Musawi

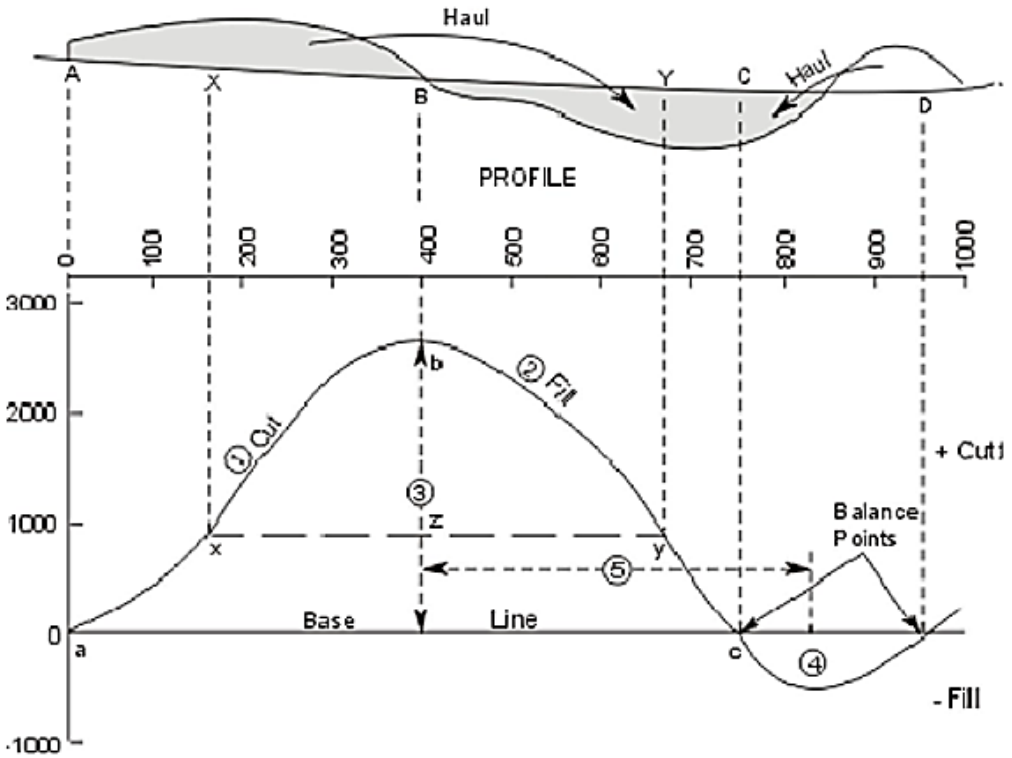
02-Earthworks & Mass-Haul Diagram

Mass-haul diagram:

Continuous curve showing the relationship between the accumulated algebraic sums of corrected earthwork volume and distance for the purpose of minimizing the cost of excavating hauling & dumping the materials (Soil).



- Rising → Cut
- Falling → Fill
- Steep slop → High cut or fill
- Zero slop → Change from cut to fill or vice v
- Zero value → Balance between cut and fill



Haul (النقل) = Volume (m^3) * Distance (sta.)

Haul distance:

The distance of moving the masses of soil from one place to another, in the process of earthwork.

Free haul distance (F. H. D.):

The distance within which there is a fixed price for excavating, hauling, and damping the materials regardless of the distance moved.

$$\text{Free haul charge} = \frac{\text{I.D}}{\text{m}^3}$$

Over haul distance (O. H. D.):

The distance beyond (F. H. D.) for which there is an additional price for each (m^3.sta.)

$$\text{Over haul charge} = \frac{\text{I.D}}{\text{m}^3.\text{sta.}}$$

$$\text{max.O.H.D.} = \frac{\text{Borrow charge}}{\text{O.H. charge}}$$

Limit of economical haul distance (L. E. H. D.):

The distance beyond which it is more economical to waste and borrow rather than to pay for the cost of over hauling.

L. E. H. D. = F. H. D. + max. O. H. D.

A-B = F. H. D.

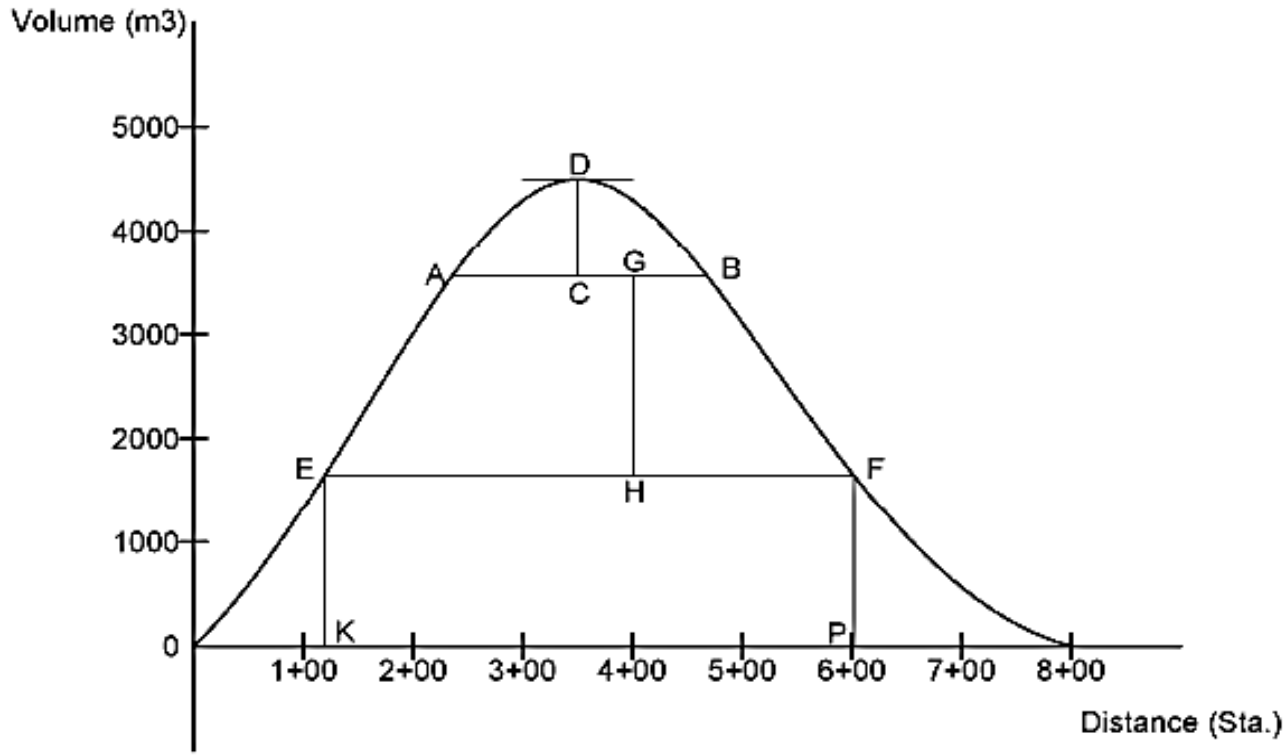
C-D = F. H. V.

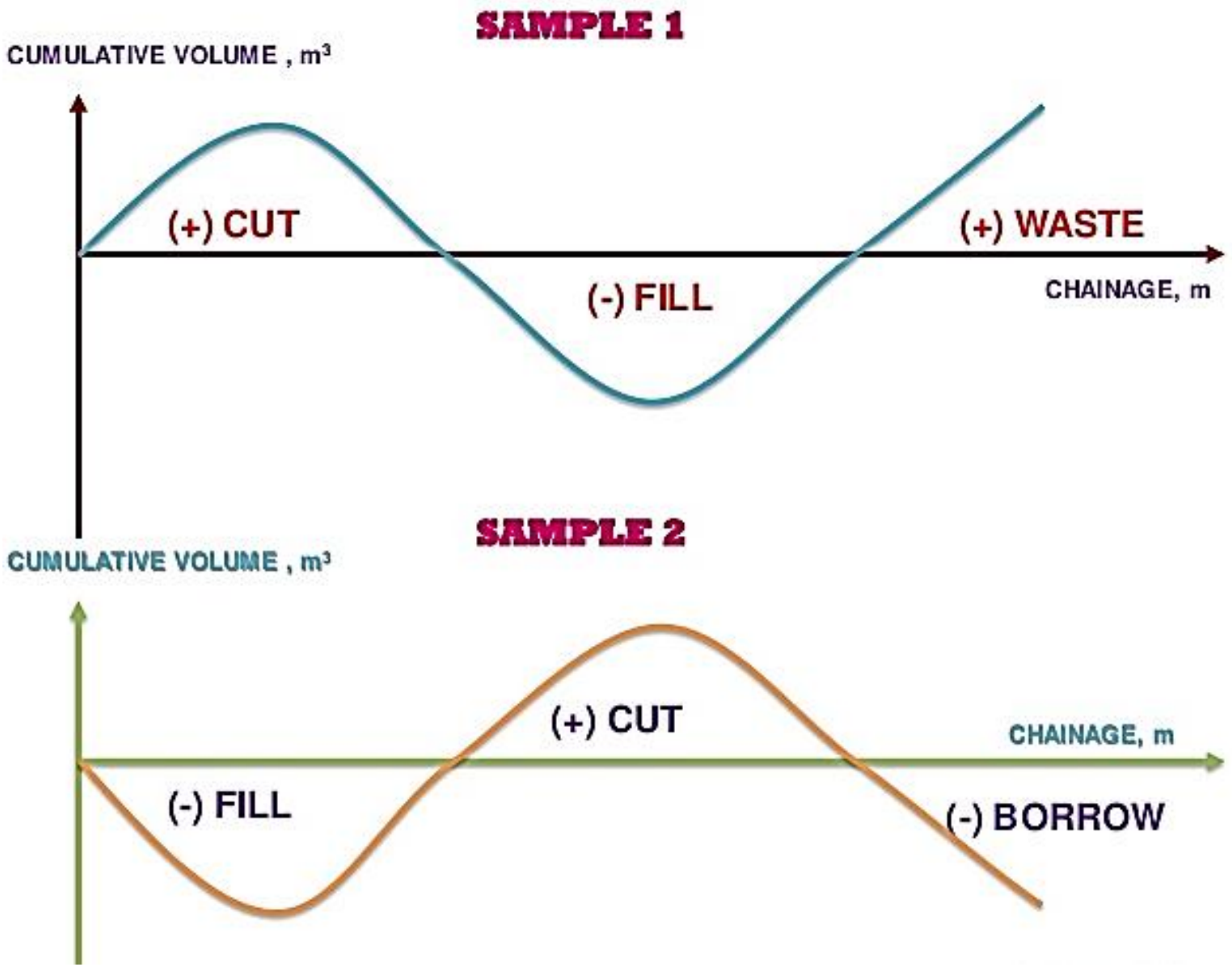
E-F = L. E. H. D.

G-H = O. H. V.

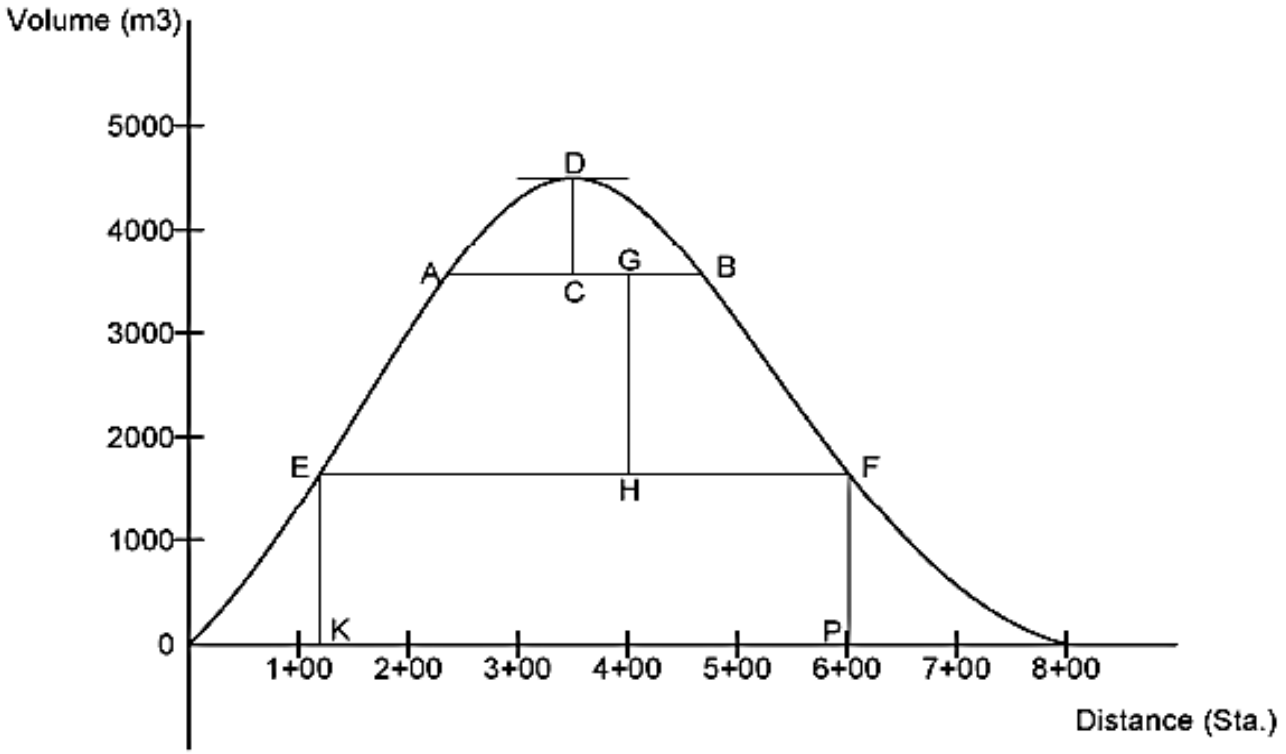
E-K = West (W)

F-P = Borrow (B)




SAMPLE 1
CUMULATIVE VOLUME , m³
(+) CUT
(+) WASTE
(-) FILL
CHAINAGE, m
SAMPLE 2
CUMULATIVE VOLUME , m³
(+) CUT
CHAINAGE, m
(-) FILL
(-) BORROW

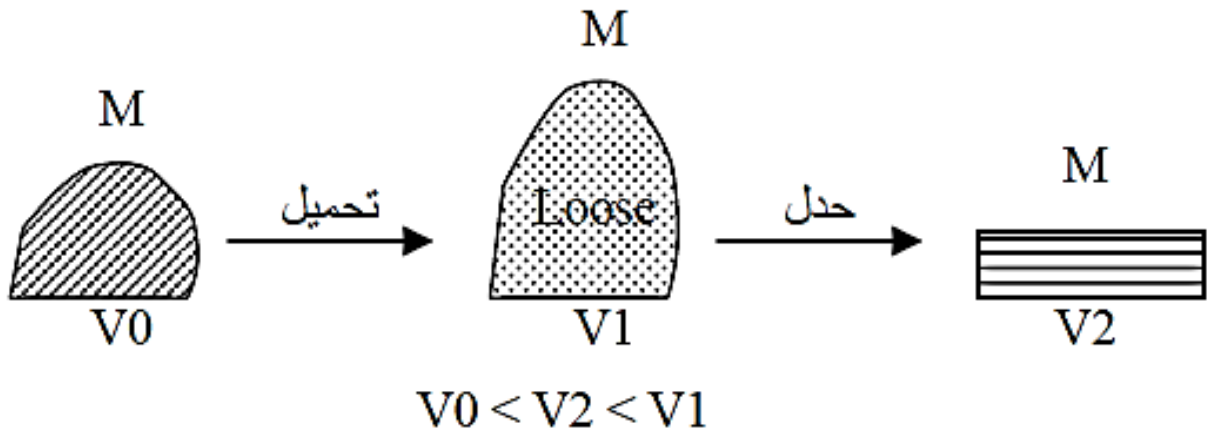
وكمثال ترسم العلاقة بين المسافة (بالمحطات) مع الحجوم المصححة المجمعة لقيم معينة بمقياس رسم معين للحصول على مخطط نقل الكتل ومنها، (A-B) هي مسافة النقل الحر ومقدارها للمثال حوالي (3Sta.) وحسب مقياس الرسم ترسم وتقاس المسافة من قمة المنحني للخط (A-B) وهي حجم الأتربة المنقولة بصورة حرة (F. H. V.). ثم نرسم الحد الاقتصادي لمسافة النقل (L. F. H. D.) وحسب مقياس الرسم فتكون المسافة (G-H) هي حجم التربة المنقولة بصورة مضافة بصورة مناسبة، أما الباقي تحت (E-F) فهي (W, B) الفائض والمستعار.



Correction:

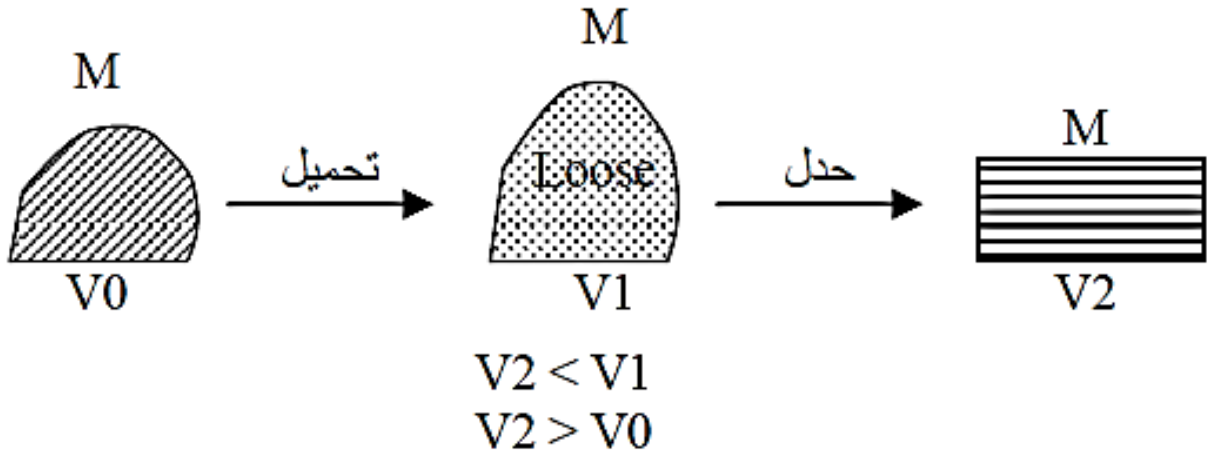
* Sandy, Silty clay

Shrinkage: 5 – 15 % ≈ 10%



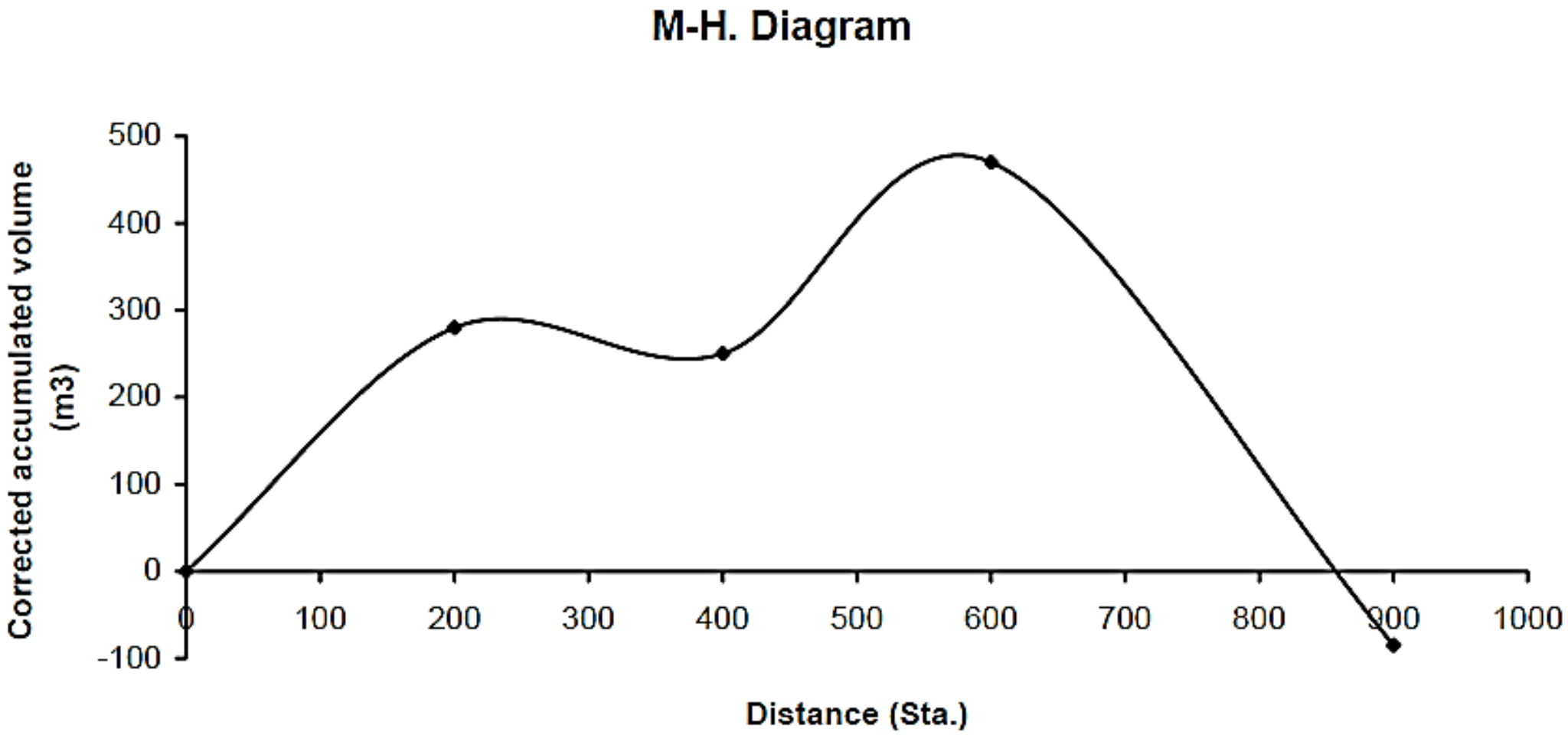
* Lime stone, Sand stone

Bulking: 25 – 35 % ≈ 30%



Ex.:

Sta.	End Area (m^2)		Cut + (m^3)	(-) Shrinkage 10% (m^3)	Corrected Cut + (m^3)	Fill – (m^3)	Balance Vol. (m^3) (Cut-Fill)	Accu. Vol. (m^3)
	Cut	Fill						
0+00	4.0	2.6						0
			0.5*(4+2)*200 =600	600*0.1 =60	600-60 =540	0.5*(2.6+0)*200 =260	+280	
2+00	2	0						+280
			0.5*(2+1)*200 =300	300*0.1 =30	300-30 =270	0.5*(0+3)*200 =300	-30	
4+00	1.0	3						+250
			0.5*(1+7)*200 =800	800*0.1 =80	800-80 =720	0.5*(3+2)*200 =500	+220	
6+00	7	2						+470
			0.5*(7+0)*300 =1050	1050*0.1 =105	1050-105 =945	0.5*(2+8)*300 =1500	-555	
9+00	0	8						-85


M-H. Diagram
Corrected accumulated volume (m3)
500
400
300
200
100
0
-100
0
100
200
300
400
500
600
700
800
900
1000
Distance (Sta.)