The total cost lines may be graphed following the method of example (2.1)

From the graph the following may be concluded.

Use site B for volume 70000 to 100000

Use site C for volume 100000 to 150000

Use site D for volumes 150000 to 170000

2.5.2 Cost Minimization Using Transportation Linear Programming

The relevant costs should include all the costs that vary from location to location such as transporation cost, distribution cost, etc. The transportation costs are important when the same product is produced at more than one plant and distributed to more than one centre. Detailed analysis of transportation costs is made using transportation method. The decision in case of opening new operation facilities is often made using transportation method, if only distribution costs are considered. The student is advised to refer to the book "Operations Research" by the same author or by any author for the details of the transportaton method. Only the application of the method is explained here through illustrated problems.

Ex. 2.3

A company having two bakeries B_1 and B_2 is supplying products to six marketing places M_1 to M_6. The capacity does not meet the current demand. Hence, the company is intending to build a new bakery at one of the two marketing locations M_3 and M_4. The additional capacity will satisfy the local sales of the market in which the bakery is located and the demand of nearby market. From the following data decide the best location.

Capacity truck load / day			
Bankery	Supply	Market	Demand
B_1	22	M_1	16
B_2	18	M_2	18
B_3	29	M_3	15
B_4	24	M_4	20
		M_5	10
		M_6	5

Distribution cost Rs. / truck load					
M_1	M_2	M_3	M_4	M_5	M_6
14	24	30	50	44	16
20	14	16	32	16	14
16	11	–	18	26	45
35	26	18	–	20	50

Solution :

Only one alternative is to be selected. Thus, if B_3 is choosen bakery site, the local market M_3 logically will be supplied by B_3. If B_4 is selected, M_4 will be the local market.

The supply at each bakery indicates the balance available for outlying market after the local demand has been met. Thus B_3 has a total capacity of 44 truck loads per day, but has only 29 truck loads available for daily shipments to other markets after supplying M_3.

Thus, the following two transportation matrices are set up, one each for B_3 and B_4 alternative.

Transporation matrix for B_3 alternative

	M_1	M_2	M_4	M_5	M_6	
B_1	[16] 14	[1] 24	50	44	[5] 16	22
B_2	20	[8] 14	32	[10] 16	14	18
B_3	16	[9] 11	[20] 18	26	45	29
	16	18	20	10	5	69

Transporation matrix for B_4 alternative

	M_1	M_2	M_3	M_5	M_6	
B_1	[16] 14	[1] 24	30	44	16	22
B_2	20	[17] 14	16	[1] 16	[5] 14	18
B_4	35	26	[15] 18	[9] 20	50	24
	16	18	15	10	5	64

The optimal distribution is also marked in the two matrices.

Total daily cost for optimal distribution if B_3 is selected = 14x16 + 24x1 + 16x5 + 14x8 + 16x10 + 11x9 + 18x20

= 1059 rupees.

Total daily cost for optimal distribution if B_4 is selected = 14x16 + 24x1 + 16x5 + 14x17 + 16x1 + 18x15 + 20x9

= 1032 rupees.

B_4 is selected as the total cost of transportation is less.

Daily saving provided by B_4 = 1059 – 1032= 27 rupees.

Ex. 2.4

A company having plants at A, B, C is supplying goods to three market places A_1, B_1, C_1. Because of the growing demand the company wants to establish another plant at D or E. From the cost, demand and production data given below, determine where the plant should be established.

Production		
Plant	Units/month	Cost/unit Rs.
A	2000	7.00
B	6000	7.08
C	5000	6.90
D	4000	6.90
E	4000	6.20

Demand	
Market	Units/month
A_1	6000
B_1	5000
C_1	6000

Transportation cost Rs. / unit

To \ From	A	B	C	D	E
A_1	5.00	7.00	5.00	4.00	6.00
B_1	6.00	4.00	7.00	3.00	4.50
C_1	5.50	7.00	3.00	5.00	5.00

Solution :

Optimal transportation tables, considering each location D and E are given below.

	A	B	C	D	
A_1	2000 5	7	5	4000 6	6000
B_1	6	5000 11	7	3	5000
C_1	1000 5.5	7	5000 3	5	6000
	2000	6000	5000	4000	17000

Transportation Cost = 2000x5 + 4000x4 + 5000x4 + 1000x7 + 5000x3 = 68000 rupees.

Production cost at D = 4000x6.90 = 27600 rupees.

Total cost = 68000 + 27600 = 95600 rupees.

	A	B	C	E	
A_1	2000 5	1000 7	5	3000 6	6000
B_1	6	5000 4	7	4.5	5000
C_1	5.5	7	5000 3	1000 5	6000
	2000	6000	5000	4000	17000

Transportation Cost = 2000x5 + 1000x7 + 3000x6 + 5000x4 + 5000x3 + 1000x5 = 75000 rupees.

Production cost at E = 4000x6.2 = 24800 rupees.

Total cost = 75000 + 24800 = 99800 rupees.

D is the best location as it has least cost.