

Concrete Products Corporation

Concrete Products Corporation has the capability of producing four types of concrete blocks. Each block must be subjected to four processes: batch mixing, mold vibrating, inspection, and yard drying. The plant manager desires to maximize profits during the next month. During the upcoming 30 days, he has 800 machine hours available on the batch mixer, 1000 hours on the mold vibrator, and 340 man-hours of inspection time. Yard-drying time is unconstrained. Taking into consideration depreciated capital investment and maintenance costs, batch mixing time is worth \$5 per hour, mold vibrating time is worth \$10 per hour, and inspection time is worth \$10 per hour, and the materials costs for the blocks are \$50, \$80, \$100, and \$120 per pallet, respectively. The production director has formulated his problem as a linear program with the following initial tableau:

	x_1	x_2	x_3	x_4	x_5	x_6	x_7		b
batch mixing	1	2	10	16	1	0	0		800
mold vibrating	1.5	2	4	5	0	1	0		1000
inspection	0.5	0.6	1	2	0	0	1		340
	80	140	300	500	0	0	0		0

where x_1, x_2, x_3, x_4 represent the number of pallets of the four types of blocks. The cost coefficients in the z-row represent the profit in dollars per pallet (not revenue!!). After solving by the Simplex method, the final tableau is:

x_1	x_2	x_3	x_4	x_5	x_6	x_7		b
0	1	11	19	1.5	-1	0		200
1	0	-12	-22	-2	2	0		400
0	0	0.4	1.6	0.1	-0.4	1		20
0	0	-280	-400	-50	-20	0		-60000

1. What is each pallet of each type of block sold for?

	x_1	x_2	x_3	x_4	x_5	x_6	x_7		b
batch mixing	1	2	10	16	1	0	0		800
mold vibrating	1.5	2	4	5	0	1	0		1000
inspection	0.5	0.6	1	2	0	0	1		340
	80	140	300	500	0	0	0		0

x_1	x_2	x_3	x_4	x_5	x_6	x_7		b
0	1	11	19	1.5	-1	0		200
1	0	-12	-22	-2	2	0		400
0	0	0.4	1.6	0.1	-0.4	1		20
0	0	-280	-400	-50	-20	0		-60000

Costs per hour (mixing,vibrating,inspection)=(5,10,10).

Material costs/pallet (\$) (type 1, type 2, type 3, type 4)=(50,80,100,120).

2. How much must a pallet of type 3 blocks be sold for in order to make it efficient to produce them?

	x_1	x_2	x_3	x_4	x_5	x_6	x_7		b
batch mixing	1	2	10	16	1	0	0		800
mold vibrating	1.5	2	4	5	0	1	0		1000
inspection	0.5	0.6	1	2	0	0	1		340
	80	140	300	500	0	0	0		0

x_1	x_2	x_3	x_4	x_5	x_6	x_7		b
0	1	11	19	1.5	-1	0		200
1	0	-12	-22	-2	2	0		400
0	0	0.4	1.6	0.1	-0.4	1		20
0	0	-280	-400	-50	-20	0		-60000

Costs per hour (mixing,vibrating,inspection)=(5,10,10).

Material costs/pallet (\$) (type 1, type 2, type 3, type 4)=(50,80,100,120).

3. What is the minimum price at which type 2 blocks can be sold and maintain them in the optimal production mix?

	x_1	x_2	x_3	x_4	x_5	x_6	x_7		b
batch mixing	1	2	10	16	1	0	0		800
mold vibrating	1.5	2	4	5	0	1	0		1000
inspection	0.5	0.6	1	2	0	0	1		340
	80	140	300	500	0	0	0		0

x_1	x_2	x_3	x_4	x_5	x_6	x_7		b
0	1	11	19	1.5	-1	0		200
1	0	-12	-22	-2	2	0		400
0	0	0.4	1.6	0.1	-0.4	1		20
0	0	-280	-400	-50	-20	0		-60000

Costs per hour (mixing,vibrating,inspection)=(5,10,10).

Material costs/pallet (\$) (type 1, type 2, type 3, type 4)=(50,80,100,120).

4. If the 800 machine hours on the batch mixer is uncertain, for what range of hours of batch mixing time is it efficient for the optimal production mix to consist of type 1 and 2 blocks?

	x_1	x_2	x_3	x_4	x_5	x_6	x_7		b
batch mixing	1	2	10	16	1	0	0		800
mold vibrating	1.5	2	4	5	0	1	0		1000
inspection	0.5	0.6	1	2	0	0	1		340
	80	140	300	500	0	0	0		0

x_1	x_2	x_3	x_4	x_5	x_6	x_7		b
0	1	11	19	1.5	-1	0		200
1	0	-12	-22	-2	2	0		400
0	0	0.4	1.6	0.1	-0.4	1		20
0	0	-280	-400	-50	-20	0		-60000

Costs per hour (mixing,vibrating,inspection)=(5,10,10).

Material costs/pallet (\$) (type 1, type 2, type 3, type 4)=(50,80,100,120).

5. A competitor has offered the manager additional batch mixing time at \$30 an hour. Neglecting transportation costs, should the manager accept this offer and if so, how many hours of batch mixing time should he purchase at this price?

	x_1	x_2	x_3	x_4	x_5	x_6	x_7		b
batch mixing	1	2	10	16	1	0	0		800
mold vibrating	1.5	2	4	5	0	1	0		1000
inspection	0.5	0.6	1	2	0	0	1		340
	80	140	300	500	0	0	0		0

x_1	x_2	x_3	x_4	x_5	x_6	x_7		b
0	1	11	19	1.5	-1	0		200
1	0	-12	-22	-2	2	0		400
0	0	0.4	1.6	0.1	-0.4	1		20
0	0	-280	-400	-50	-20	0		-60000

Costs per hour (mixing,vibrating,inspection)=(5,10,10).

Material costs/pallet (\$) (type 1, type 2, type 3, type 4)=(50,80,100,120).

6. The market for type 2 blocks has gotten hot lately. We can now sell them for \$30 more than we used to. If we make this increase, what is the new optimal production schedule ?

	x_1	x_2	x_3	x_4	x_5	x_6	x_7		b
batch mixing	1	2	10	16	1	0	0		800
mold vibrating	1.5	2	4	5	0	1	0		1000
inspection	0.5	0.6	1	2	0	0	1		340
	80	140	300	500	0	0	0		0

x_1	x_2	x_3	x_4	x_5	x_6	x_7		b
0	1	11	19	1.5	-1	0		200
1	0	-12	-22	-2	2	0		400
0	0	0.4	1.6	0.1	-0.4	1		20
0	0	-280	-400	-50	-20	0		-60000

Costs per hour (mixing,vibrating,inspection)=(5,10,10).

Material costs/pallet (\$) (type 1, type 2, type 3, type 4)=(50,80,100,120).

7. The mold vibrator needs major repairs. Consequently, we will lose 300 hours of mold vibrating time this month. What should be the new production schedule for this month ?

	x_1	x_2	x_3	x_4	x_5	x_6	x_7		b
batch mixing	1	2	10	16	1	0	0		800
mold vibrating	1.5	2	4	5	0	1	0		1000
inspection	0.5	0.6	1	2	0	0	1		340
	80	140	300	500	0	0	0		0

x_1	x_2	x_3	x_4	x_5	x_6	x_7		b
0	1	11	19	1.5	-1	0		200
1	0	-12	-22	-2	2	0		400
0	0	0.4	1.6	0.1	-0.4	1		20
0	0	-280	-400	-50	-20	0		-60000

Costs per hour (mixing,vibrating,inspection)=(5,10,10).

Material costs/pallet (\$) (type 1, type 2, type 3, type 4)=(50,80,100,120).

8. We intend to introduce a new type of block. This block requires 4 hours of batch mixing time, 4 hours mold vibrating time, and 1 hour of inspection time per pallet. The materials costs for this type of block are \$80 per pallet. At what price must this product be sold in order to make it efficient to produce ?

	x_1	x_2	x_3	x_4	x_5	x_6	x_7		b
batch mixing	1	2	10	16	1	0	0		800
mold vibrating	1.5	2	4	5	0	1	0		1000
inspection	0.5	0.6	1	2	0	0	1		340
	80	140	300	500	0	0	0		0

x_1	x_2	x_3	x_4	x_5	x_6	x_7		b
0	1	11	19	1.5	-1	0		200
1	0	-12	-22	-2	2	0		400
0	0	0.4	1.6	0.1	-0.4	1		20
0	0	-280	-400	-50	-20	0		-60000

Costs per hour (mixing,vibrating,inspection)=(5,10,10).

Material costs/pallet (\$) (type 1, type 2, type 3, type 4)=(50,80,100,120).