depth about equal to the width. Such buckets are referred to in terms of length and width of bucket, so that the carrying capacity of any standard bucket carrier, loaded with any given material, is dependent upon the spacing of the buckets and the speed at which the carrier is run. Table XI. gives the average carrying capacity of certain common sizes of bucket carriers (length of bucket times in width) when handling material weighing 100 pounds per cubic foot at a carrier speed of 50 feet per minute. At equal spacing of buckets, the carrying capacity of bucket carriers handling other material at other speeds is directly proportional to both weight of material carried and speed of carrier. These definite relations and the fact that all standard buckets are similarly proportioned, permits the expression of the carrying capacity of any standard bucket carrier in the form of a convenient equation. (See Formula XXI.).

Table XI.—Capacity of Bucket Carriers in Tons Per Hour. Material Weighing 100 Pounds Per Cubic Foot. Carrier Speed, 50 Feet Per Minute.

Bucket length x width	Spaced 18 in.	24 in.	30 in.	36 in.
12 in. x 12 in.	25.76	19.36	15.41	12.84
16 in. x 12 in.	34.24	25.68	20.55	17.12
16 in. x 15 in.	53.60	40.20	32.15	26.80
18 in. x 15 in.	60.15	45.10	36.10	30.07
20 in. x 15 in.	—	52.40	41.90	33.45
24 in. x 15 in.	—	60.10	48.00	39.60
20 in. x 20 in.	—	88 80	71.00	59.30
24 in. x 20 in.	—	106.70	85.40	70.40
30 in. x 20 in.	—	—	106.70	89.10
36 in. x 20 in.	—	—	128.00	106.70
30 in. x 24 in.	—	—	—	124.60
36 in. x 24 in.	—	—	—	153.72

$$\text{Capacity}: \quad W = \frac{0.00535 \times w^2 \times l \times w'}{S''} \qquad \text{Formula XXI.}$$

Where:
W = Capacity in tons per hour.
w = Width of bucket in inches.
l = Length of bucket in inches,
w' = Weight of material handled in lbs. per cu. ft.
S'' = Spacing of buckets in inches.

Though the average speed of a bucket carrier is about 50 feet per minute, all materials are not most economically carried at that speed. Certain materials permit considerably higher speeds, while others must be handled more slowly, or excessive breakage, etc., is apt to occur. Table XII. gives speeds that have been found to be economic for certain of the common materials usually handled by such equipment. These speeds are by no means fixed, however, and considerable variation is permissible and not infrequently advisable. In fact, some authorities recommend quite different speeds for some of the materials mentioned in Table XII. However, the data of this table has been collected from numerous efficient installations of bucket carriers and may safely be used as a basis of operation.

Table XII.—Economic Speeds of Bucket Carriers for Various Materials.

Material	Advisable Speed
Coke	40 feet per minute
Broken Stone (coarse); Lump Coal—R.M.	50 feet per minute
Ashes, Lime and Cement	60 feet per minute
Ore, Crushed Stone, Sand and Gravel	70 feet per minute
Fine Coal	80 feet per minute

The consumption of power by the rigid bucket and by the pivoted bucket types of bucket carriers naturally differs considerably, but the difference is somewhat equalized by the fact that the pivoted bucket type is nearly invariably furnished with a reciprocating feeder that consumes quite appreciable power. Other than for this special feature of the pivoted bucket carrier, three distinct operations consume power whether the carrier is of the rigid bucket or pivoted bucket construction: 1st, the running of the apparatus itself, which depends upon the total weight of the moving parts—the weight of the endless chains, the buckets and the attachments; 2nd, the carrying of the load horizontally; and 3rd, the operation of elevating the load. Although load may be carried in two general directions by a bucket carrier, such double transfer of load is seldom, if ever, accomplished at the same time, so that it is customary to figure an allowance of power for conveying in one direction only. The elevating operations consume only about the theoretical power required for the load, as the descending buckets and chains compensate for the work of raising these parts and the friction and other unavoidable losses are almost independent of the height of lift, so are allowed for in the power provisions for horizontal travel of load. Standardization of equipment permits the expression of the weight of the moving parts of the carrier in terms of its carrying capacity in tons per hour, for the strength, hence the weight of the chains, attachments and buckets vary very closely with the load that the carrier is capable of handling. In the derivation of Formulæ XXII. and XXII-a, the value of all constants are based on actual results obtained in a number of successful and economic installations of such equipment and, though the results given by such formulæ may be somewhat higher than the claims advanced by certain manufacturers of bucket carriers, dependence upon the use of formulæ for deriving horsepower requirements of bucket carriers that give smaller results is inadvisable, for so many conditions really effect the question of power consumption by such equipment that no theoretical equation can be derived that will fit all cases.

Horsepower:—

W = Weight of load handled in tons per hour.
L = Length (total) of horizontal stretches of Carrier in one general direction in feet.
H = Height (total) or distance through which load is elevated in feet.
V = Velocity (speed) of Carrier in feet per minute.
W_c = Weight of moving parts of Carrier in lbs. per foot.
= 0.608 W—Carriers with rigid buckets.
= 0.756 W—Carriers with pivoted buckets.
W' = Weight of load handled in lbs. per minute.
= 33 W

$$\frac{W'}{V} = \frac{33\,W}{V} = \text{weight of load handled in lbs. per minute per foot.}$$

f_s = Speed factor = 0.18 —Carriers with rigid buckets.
= 0.035—Carriers with pivoted buckets.
f_l = load factor = 0.70—Carriers with rigid buckets.
= 0.20—Carriers with pivoted buckets.

Horsepower required to run empty carrier:—

Carriers with rigid buckets.

Total weight of moving parts = $2(H + L)W_c$
Average velocity of Carrier (V) = 50 feet per minute.

$$HP = \frac{2(H + L)W_c \times V \times f_s}{33000} = \frac{2(H + L) \times 0.608\,W \times 50 \times 0.18}{33000}$$

$$= \frac{33\,(H + L)W}{100{,}000}$$

Carriers with pivoted buckets.

Total weight of moving parts = $2(H + L)W_c$
Average velocity of Carrier (V) = 50 feet per minute.

$$HP = \frac{2(H + L)W_c \times V \times f_s}{33000} = \frac{2(H + L) \times 0.756\,W \times 50 \times 0.35}{33000}$$

$$= \frac{8(H + L)W}{100000}$$