

Average Production Rates for Major Equipment*

•A CONCISE summary of average production rates for key road construction equipment units is presented here for reference use. These rates were developed by analyzing data from field research studies conducted by the U. S. Bureau of Public Roads. The equipment studied was operated under a variety of job conditions and management practices during construction of several hundred highway projects located throughout the United States.

Individual job cases with production rates of ± 35 to 50 percent of the average were not uncommon. In extreme cases, production rates varied from the average by as

TABLE 1
OBSERVED AVERAGE PRODUCTION RATES FOR MAJOR EQUIPMENT: EXCAVATION OPERATIONS
(Rates for Individual Jobs Can Be Expected To Range Between 50 and 150 Percent of Average Rates)

Class of Equipment	Total No. of Observed Machines	Average Production per Hour of:		
		Productive Time	Net Average Working Time	Scheduled Shift Time
A. Power shovels—Roadway excavation (1½-5 cubic yards)	80	104 "units"	67 "units"	57 "units"
Multiply "units" by dipper struck capacity (cubic yards) to obtain pay yards per hour				
B. Power shovels—Borrow pit excavation (1½-2 cubic yards)	4	178 "units"	128 "units"	120 "units"
Multiply "units" by dipper struck capacity (cubic yards) to obtain pay yards per hour				
C. Draglines—Roadway and pit excavation (1-5 cubic yards)	9	147 "units"	94 "units"	83 "units"
Multiply "units" by bucket struck capacity (cubic yards) to obtain pay yards per hour				
D. Elevating graders pulled by crawler tractors	8	707 pay yards	541 pay yards	484 pay yards
E. Scrapers pulled by crawler tractors (8-26 cubic yards)	78			
1. 250 ft apparent haul distance ¹		12.4 loads	10.4 loads	8.2 loads
2. 500 ft apparent haul distance		9.4 loads	8.2 loads	6.8 loads
3. 750 ft apparent haul distance		7.9 loads	7.0 loads	5.9 loads
4. 1000 ft apparent haul distance		7.0 loads	6.3 loads	5.4 loads
5. 1250 ft apparent haul distance		6.5 loads	5.9 loads	5.1 loads
For scrapers up to 21 cubic yards struck capacity, multiply loads by 80 percent of struck capacity (cubic yards) to obtain pay yards per hour				
For scrapers over 21 cubic yards struck capacity, multiply loads by 70 percent of struck capacity (cubic yards) to obtain pay yards per hour				
F. Scrapers pulled by rubber-tired tractors (5-32 cubic yards)	246			
1. 250 ft apparent haul distance ¹		30.3 loads	17.5 loads	11.9 loads
2. 500 ft apparent haul distance		21.2 loads	14.1 loads	10.2 loads
3. 750 ft apparent haul distance		16.8 loads	11.9 loads	9.1 loads
4. 1000 ft apparent haul distance		14.2 loads	10.6 loads	8.3 loads
5. 1250 ft apparent haul distance		12.5 loads	9.6 loads	7.7 loads
6. 1500 ft apparent haul distance		11.2 loads	8.9 loads	7.2 loads
7. 2000 ft apparent haul distance		9.6 loads	7.8 loads	6.4 loads
8. 2500 ft apparent haul distance		8.5 loads	7.0 loads	5.9 loads
9. 3000 ft apparent haul distance		7.7 loads	6.5 loads	5.5 loads
10. 3500 ft apparent haul distance		7.2 loads	6.1 loads	5.2 loads
11. 4000 ft apparent haul distance		6.8 loads	5.8 loads	5.0 loads
12. 4500 ft apparent haul distance		6.5 loads	5.6 loads	4.9 loads
13. 5000 ft apparent haul distance		6.2 loads	5.4 loads	4.8 loads
For scrapers up to 21 cubic yards struck capacity, multiply loads by 90 percent of struck capacity (cubic yards) to obtain pay yards per hour				
For scrapers over 21 cubic yards struck capacity, multiply loads by 80 percent of struck capacity (cubic yards) to obtain pay yards per hour				

¹Length of path actually traveled between end of load at cut and start of dump at fill.

*The average production rates published here summarize the results of production rate studies assembled since HRB Special Report No. 68, "Construction and Maintenance", was published in 1962. Many valuable contributions in the preparation of this report were made by Morgan J. Kilpatrick and W. N. Records of the U.S. Bureau of Public Roads, and the Committee on Highway Equipment is indebted to them for making the material available for publication.

TABLE 2
OBSERVED AVERAGE PRODUCTION RATES FOR MAJOR EQUIPMENT: BASE AND PAVEMENT OPERATIONS
 (Rates for Individual Jobs Can Be Expected To Range Between 65 and 135 Percent of Average Rates)

Class of Equipment	Total No. of Observed Machines or Plants	Average Production per Hour of:		
		Productive Time	Net Available Working Time	Scheduled Shift Time
A. Portable-type crushing plants	11	255 tons	192 tons	140 tons
B. Roadmix stabilization machines				
1. Towed by tractors	5	645 square yards	570 square yards	422 square yards
2. Self-propelled	12	1303 square yards	1118 square yards	699 square yards
C. Continuous-type stabilization plants	4	441 tons	364 tons	326 tons
D. Continuous-type bituminous hot-mix plants				
1. 90-175 tons per hour rated capacity	13	148 tons	114 tons	90 tons
2. 250-500 tons per hour rated capacity	3	342 tons	294 tons	255 tons
E. Batch-type bituminous hot-mix plants (1-5 tons)	61	74 batches	53 batches	41 batches
Multiply batches by batch size (tons) to obtain tons per hour				
F. Concrete pavers (34E mixers)				
1. Double drum type	91	97 batches	63 batches	51 batches
2. Triple drum type	9	120 batches	75 batches	59 batches
Multiply batches by batch size (cubic yards) to obtain cubic yards per hour				
G. Concrete plants (108-254S)				
1. One cascading drum- or turbine-type mixer	15	34 batches	25 batches	20 batches
2. Two cascading drum-type mixers	9	67 batches	40 batches	37 batches
Multiply batches by batch size (cubic yards) to obtain cubic yards per hour				

much as minus 75 percent or plus 125 percent. In general, paving work had the least and excavation work the most variation.

Each type of key equipment studied experienced lost time due to a variety of delay causes. The magnitude of these time losses is reflected in the production rates reported under three different time classifications as follows:

1. Productive time rates, computed with the time for all delays excluded;
2. Net available working time rates, computed by excluding only the time for individual delays that lasted 15 minutes or more; and
3. Scheduled shift time rates, computed by excluding only the time for individual weather-caused delays that lasted 15 minutes or more.