beds and the physical conditions in and surrounding these beds were determined from cores of 24 diamond-drill holes. Diamond-drill cores of the coal beds also were used for petrographic examination and chemical analyses.

The field investigation was completed; and the results of the work, including estimated reserves, petrography, and chemical properties of the coals and the washability characteristics of coal from the Fairview bed, will be published.

Castleman Coal Basin, Md.

A source of low-volatile, semismokeless coal, especially desirable for use as smokeless fuel in cities and for blending with high-volatile coal for making metallurgical coke, is indicated in the Castleman Basin of Maryland. Because of the nearness of this field to users of low- to medium-volatile coal, an investigation of the field has been undertaken to determine minable reserves of coal in the area. Development of modern, mechanized mines cannot be undertaken until the reserves are established.

Deep River, N. C.

Investigation of the Deep River coal field was begun in June 1947 and is in progress. Additional diamond drilling is being done to determine the minable reserves of coal in this field. Preliminary tests of the coal indicate that it has coking properties.

This coal field is situated in a center of population which now is supplied principally with fuel from the distant West Virginia and Virginia coal fields. The cost of this coal is necessarily high. Should the investigation prove minable reserves sufficient for the development of a modern mine, fuel costs in this area should be reduced materially.

The area being investigated in the Deep River field comprises approximately 1,250 acres.

Alaska

An area of bituminous coal in Alaska, east of Eska Creek adjacent to the abandoned Eska mine had been studied by geologists of the Federal Geological Survey. This study indicated that physical conditions were favorable for the development of a modern mechanized mine should minable reserves of coal be proved by diamond drilling. This area is accessible to the surface plant and washery of the Eska mine, and these facilities could be used if the investigation by diamond drilling proved a reserve of minable coal. Diamond drilling in this area was in progress at the end of the fiscal year. The reported life of the Evan Jones mine, which is the only operating bituminous mine in Alaska, is 3 years, and should the investigations in the Eska Creek area develop a mine site, an operation here could supply bituminous coal until the minable reserves in the Wishbone Hill area can be established, and the possibility of developing a large modern mine in this area determined.

Mining Methods and Practices

Strip Mining of Bituminous Coal

The urgent need for coal to supply industry, which expanded rapidly during the war, accelerated the use of scrapers and light earth-moving equipment in bituminous-coal strip mining. The coal industry experienced a severe shortage in manpower and difficulty in obtaining equipment for new underground mines and replacements for worn-out machinery in operating mines. Strip mining requires fewer man-hours per ton of production than underground mining in similar beds, and the time for developing a strip mine is shorter than that required for developing an underground mine of the same capacity. In Maryland, Pennsylvania, and West Virginia, the production of strip-mined coal increased between 1941 and 1945. In Maryland the increase was from 0.7 percent to 11.6 percent of the total bituminous-coal production in the State. The increase in Pennsylvania was from 6.5 percent to 20.6 percent and in West Virginia from 0.8 percent to 9.3 percent.

In recent years there has been rapid progress in the technique of strip-coal mining. Introduction of the use of scrapers and other light earth-moving equipment in strip mining of relatively small areas of coal in mountainous terrain is one of the recent advancements in the practice of coal strip mining and is responsible for the recovery of many small areas of coal that could not be mined economically in any other way. Coal beds underlying many of these areas cannot be mined by underground methods because of the shallow overburden and the difficulty of supporting the weak strata overlying the coal. Reserves of coal in place in these areas usually are not sufficient to justify the large initial cost of large shovels or draglines.

The operations at one mine in Maryland, one mine in Pennsylvania, and four mines in West Virginia using tractor-scrapers and other light earth-moving equipment were studied.16/

The areas at most of the mines were explored, by the owners, by diamond drilling, trenches dug by bulldozers, or hand-dug test pits before stripping was started. This exploration determined the location of the outcrop and the thickness and character of the overburden and also located the limit of weathered coal. The overburden moved at the mines studied ranges from a few feet to a maximum of 60 feet of soil, clay, shale, and limestone.

Tractor-scrapers ordinarily are used to move the overburden in outcrop and contour stripping in areas where the topography is rolling or hilly and favorable for the disposal of overburden in spoil piles entirely removed from the strip mine. The portion of the overburden moved by these units ranges from 12 to 50 feet of soil, clay, and shale. At two mines, small stripping shovels also were used in conjunction with tractor-scrapers.

16/ Turnbull, Louis A., Shields, Joseph J., Dowd, James J., Fish, Edward L., and Toenges, Albert L., Use of Scrapers and Other Light Earth-Moving Equipment in Bituminous-Coal Strip Mining: Bureau of Mines Rept. of Investigations 4033, 1947, 37 pp.

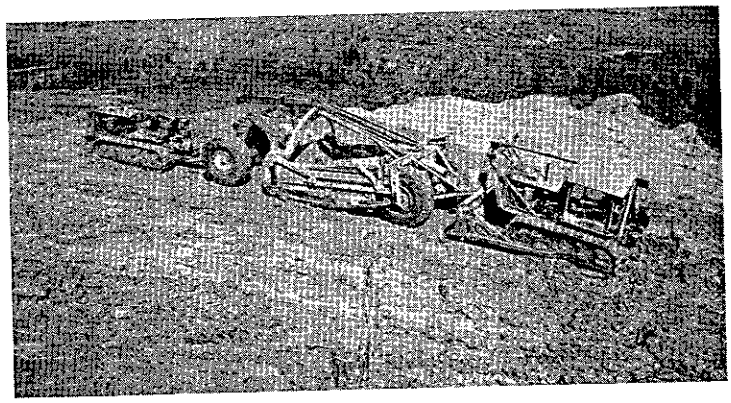


Figure 16. - Loading scraper, tractor pulling, bulldozer pushing, West Virginia.

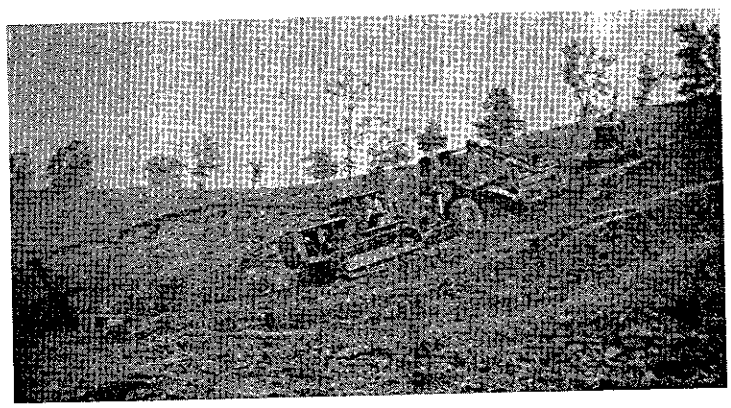


Figure 17. - Tractor-scraper digging shale. Tractor in background moving into position to push unit while loading, West Virginia.

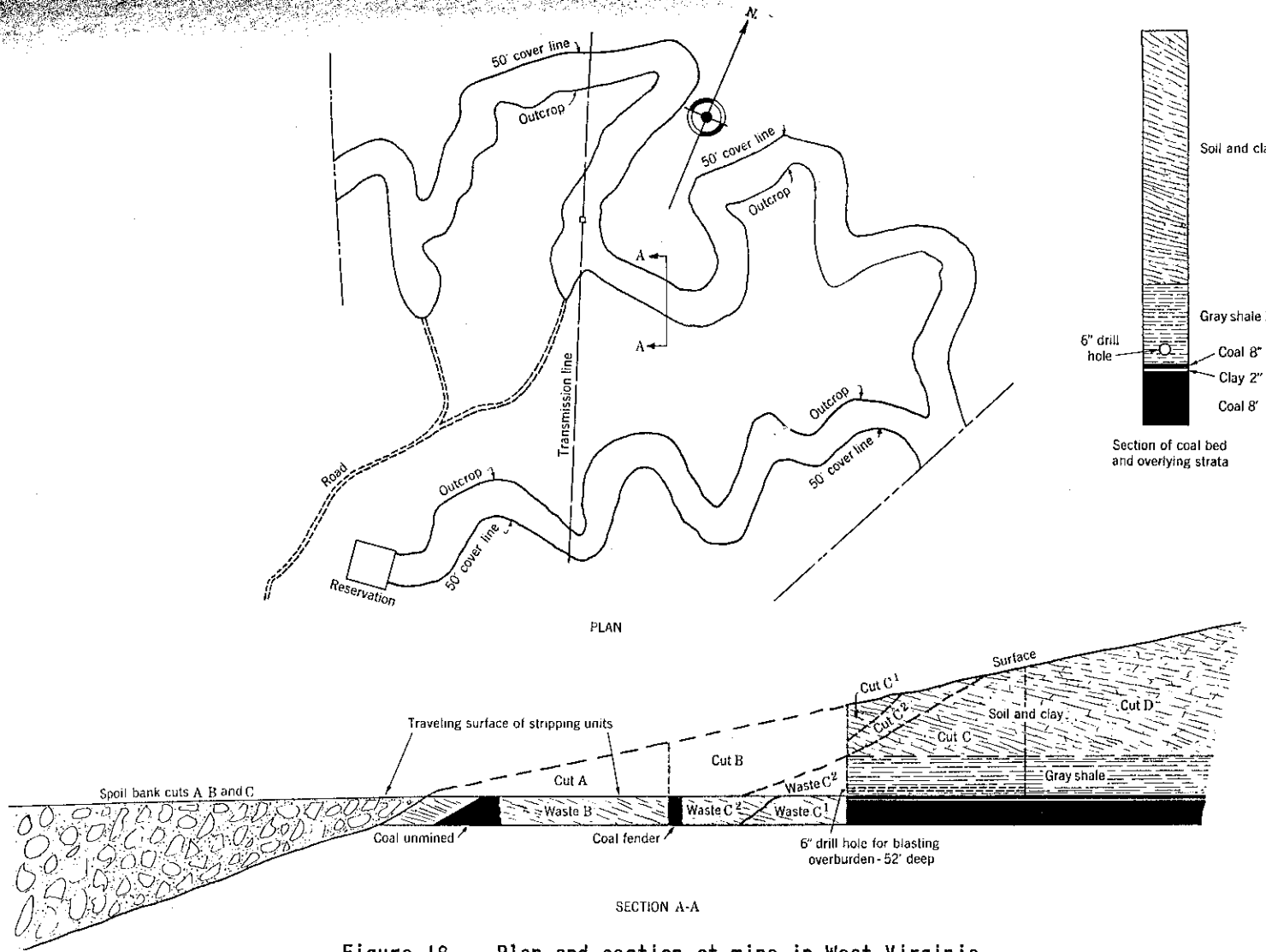


Figure 18. - Plan and section at mine in West Virginia.

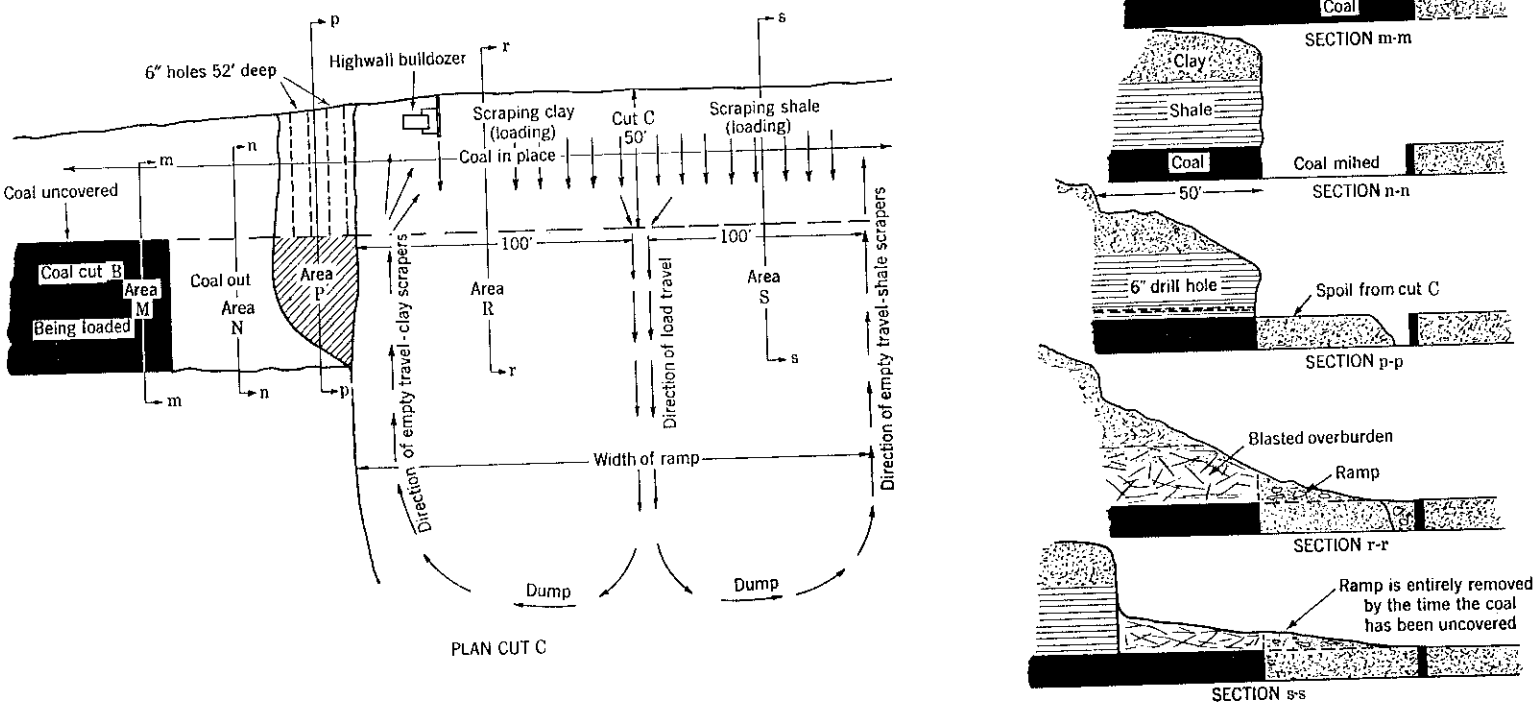


Figure 19. - Mining method, West Virginia.

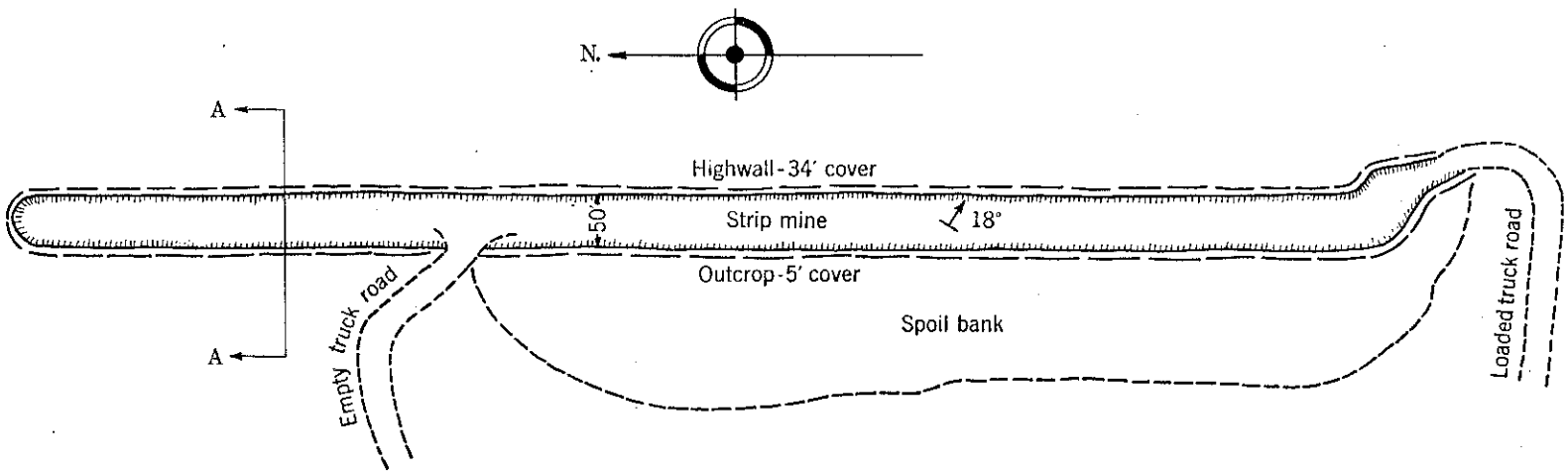
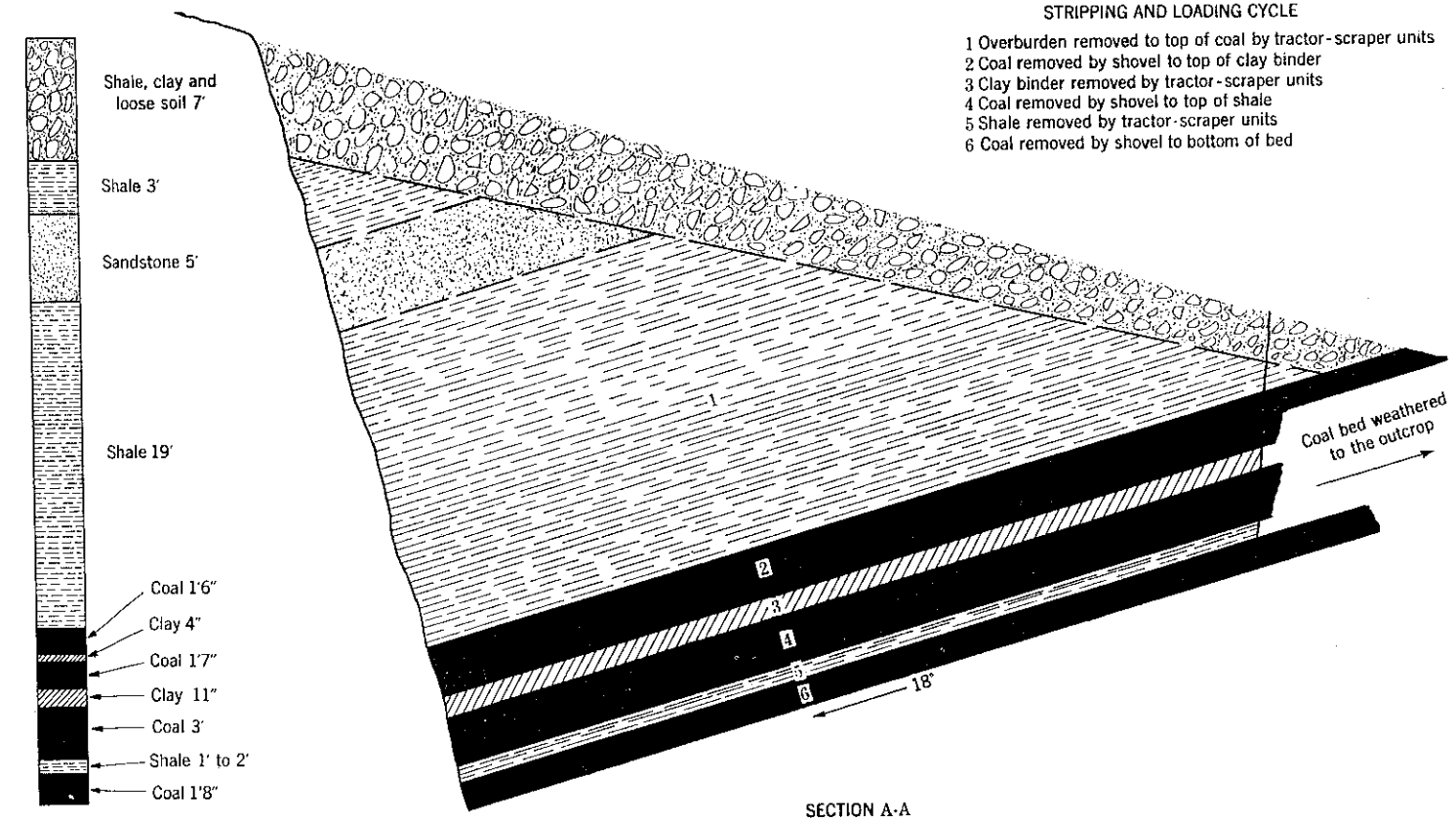


Figure 20. - Plan of mine, Maryland.



Section of coal bed and overlaying strata mine 3

Figure 21. - Section of mine and mining cycle, Maryland.

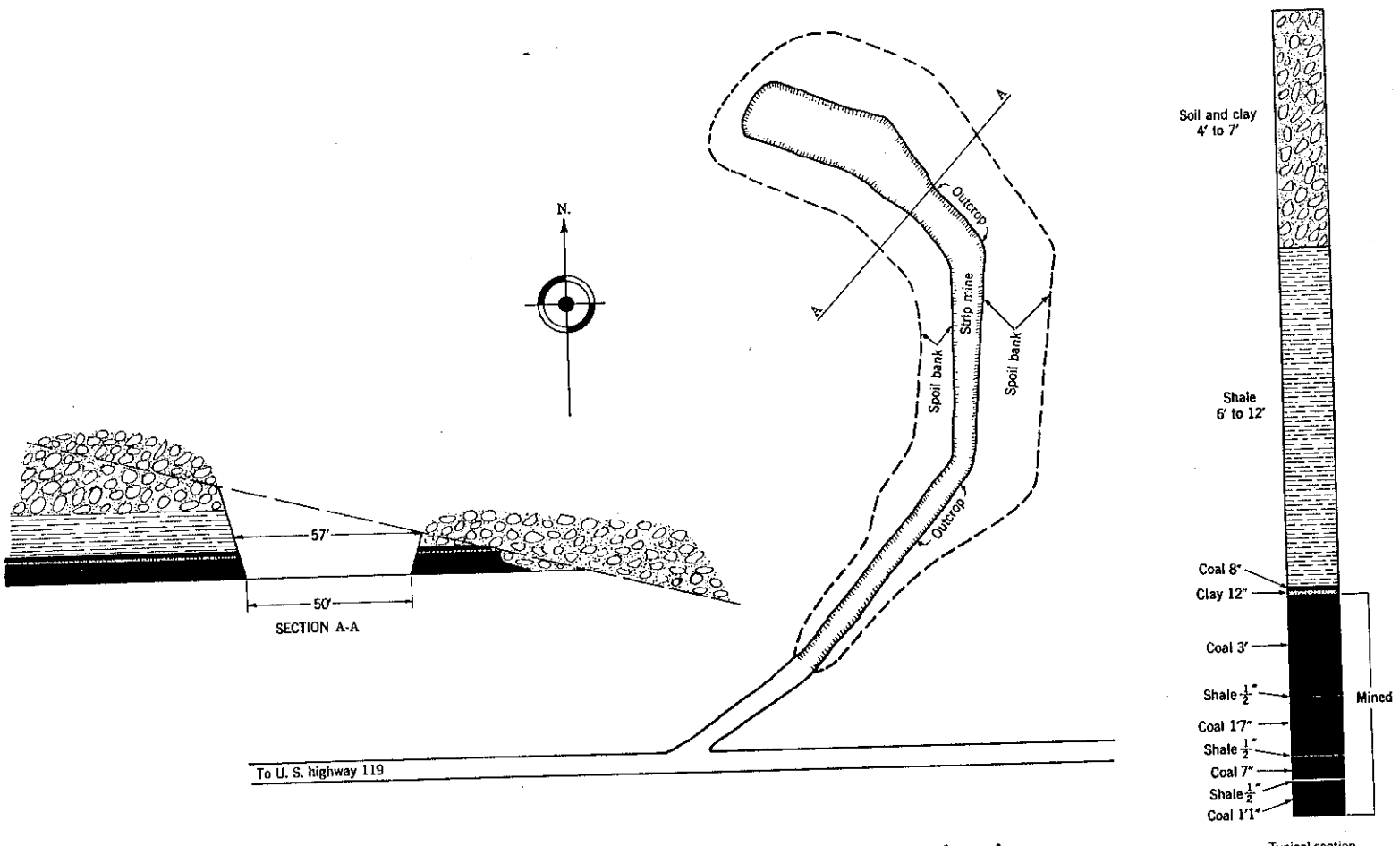


Figure 22. - Mine plan and section, Pennsylvania.

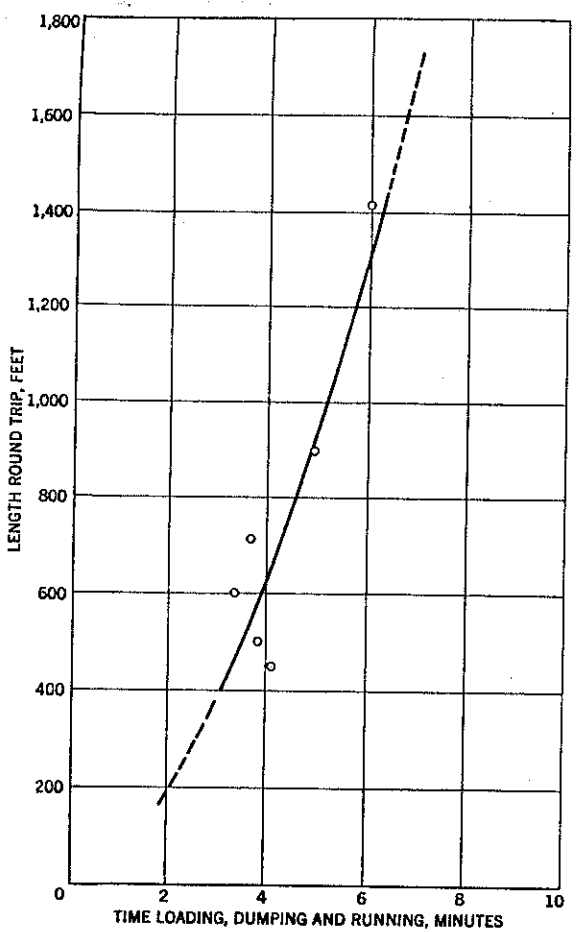


Figure 23. - Relation of average round-trip cycle (feet) to time (minutes) for tractor-scrapers.

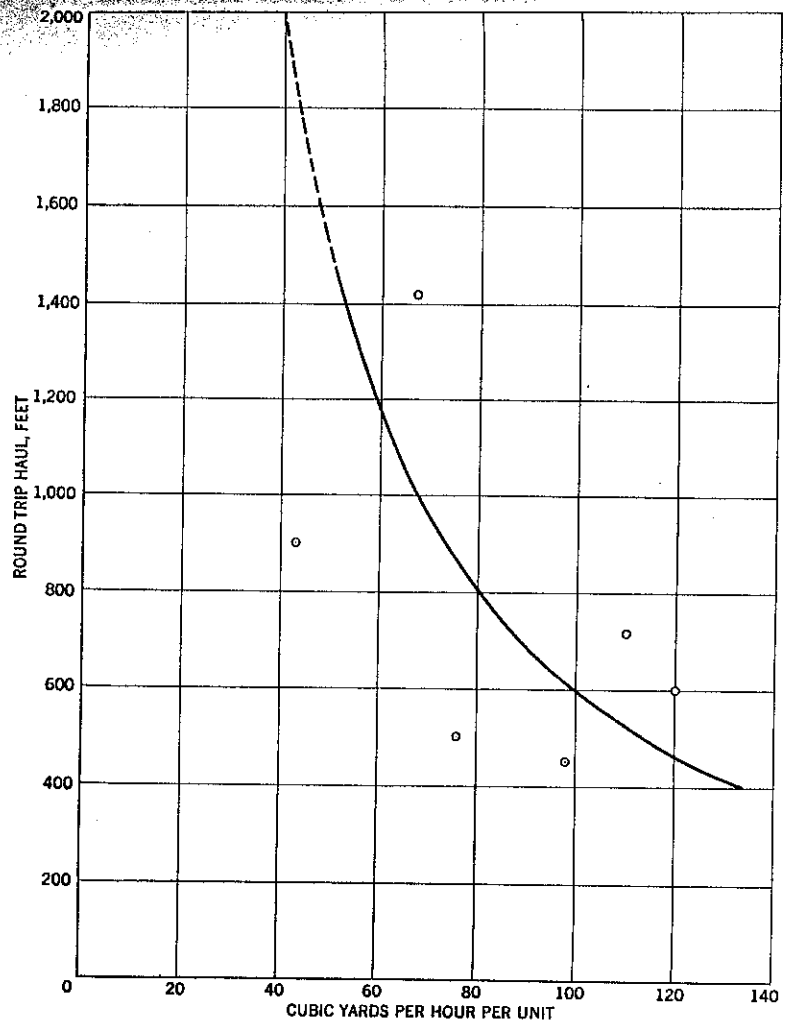


Figure 24. - Relation of cubic yards transported per hour per tractor scraper to round trip (feet).

At four mines, the overburden is blasted to obtain fragmentation before the material is moved. Horizontal holes 6 inches in diameter are drilled in the shale 2 to 2-1/2 feet above the top of the coal bed. The holes are spaced 12 to 20 feet apart, depending on the thickness and character of the overburden and drilled 45 to 54 feet deep, depending on the width of the cut desired. Holes are charged with 150 to 257 pounds of explosive, which is detonated electrically.

The rated capacity of the scrapers used is 12, 15, and 25 cubic yards, and these units carry an average payload of 8, 10, and 18 cubic yards, respectively. The scrapers are pulled by Diesel-powered tractors and pushed by Diesel-powered pushers or bulldozers. (See figs. 16 and 17.) The average length of round-trip hauls varies considerably, owing principally to the topography of the surface and the amount of spoil to be moved beyond the outcrop. Usually, bulldozers shape and grade the spoil banks away from the strip mine in favor of drainage. Mining methods followed at mines studied in West Virginia, Maryland, and Pennsylvania are shown in figures 18, 19, 20, 21, and 22.

At most of the mines visited, the coal required drilling and blasting. Holes are spaced on 4- to 9-foot centers, depending on the hardness of the coal. The coal is loaded into trucks with small Diesel- or gasoline-powered shovels, which operate on the clay bottom underlying the coal. At three mines, the loaded coal trucks operate on top of the coal bed and at the other mines on the underlying clay. The coal is transported by trucks to tipples, which usually are at railroad loading points. These trucks operate over roads built and maintained by the operators or over State and county highways. The coal is hand-picked at the tipple and usually is loaded into railroad cars as run-of-mine. However, at two mines, the strip-mined coal is mixed with coal from underground mines and passes through the screening plants at these mines.

The following curves were plotted from time studies and other data obtained:

Figure 23. - Relation of average round-trip cycle (feet) to time (minutes) for tractor-scrapers:

> This curve is based upon the weighted average performance of tractor-scraper units at all mines studied and reflects the time required for these units to complete round trips for distances ranging from 200 to 1,800 feet. All tractor-scrapers are operated under similar physical conditions, although they are of different capacities. The grouping of points computed for each mine is near the curve and shows that the size of the scraper has little relation to the time cycle. The rate of increase in time to complete the cycle decreases as the length of round-trip haul increases.

Figure 23 shows the advantage of maintaining short hauls. For example, there is an increase of 35 cubic yards transported