

## SOME TUNNELING COSTS.

THE United States Bureau of Mines has made exhaustive investigation into the subject of mine tunneling, and, in the course of the work, found that data respecting tunneling costs were remarkably scarce. The Bureau thereupon undertook to gather the available data, which have been published in a recent bulletin from which the following statistics have been compiled:—

## LOS ANGELES AQUEDUCT.

## Little Lake Division, Tunnels 1 to 10A.

Location: Inyo County, Cal.

Purpose: Water supply, power and irrigation.

Cross-section: Straight walls, arched roof, dished bottom.

Size: 7 feet 10 inches wide by 8 feet 5 inches wide.

Type of power: Electric power purchased at a nominal cost per kilowatt-hour from a hydraulic plant constructed and owned by the aqueduct.

Ventilators: Pressure blowers.

Size of ventilating pipe: 12 inches.

Drills: Pneumatic hammer, usually 2 in each heading.

Mounting of drills: Horizontal bar.

Number of holes per round: Usually 14 to 16.

Average depth of round: 6 to 10 feet.

Number of drillers and helpers per shift: 2 drillers and 2 helpers.

Number of drill shifts per day: Usually 1, but sometimes 2.

Explosive: 40 per cent. gelatine dynamite, with some 20 per cent. and some 60 per cent. Ammonia dynamite also tried.

Number of muckers per shift: Usually 5.

Number of mucking shifts per day: Usually 1, but 2 when 2 drill shifts were employed.

Type haulage: Tunnels 1 to 3-N, mules; tunnels 3-S, to 10A-N, electric; tunnel 10A-S, mules.

Wages: Drillers and helpers \$3, muckers, \$2.50, blacksmiths \$4, helpers \$2.50, motormen \$2.75, dumpmen \$2.50.

## Tunnel 1B-S, Length 1,341 Feet.

(Through medium-hard granite at an average speed of 225 feet per month.)

	Cost per foot of tunnel.
Excavation .....	\$ 9.15
Engineering .....	.18
Adit proportion .....	.28
Permanent equipment (estimated) .....	2.35
Timbering (857 feet) .....	1.02
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	\$12.98

In this tunnel, as in all of the tunnels of this division and of the Grapevine division, the cost of excavation includes the wages of shift foremen, drillers, helpers, muckers, motormen or mule drivers, dumpmen, blacksmiths and helpers, machinists, electricians (part), and power engineers; also the cost of powder, fuse caps, candles, light globes, machine oil, blacksmith supplies and fuel, and machinists' supplies, and the cost of power and of repairs for power, haulage, compressor, and ventilating machinery.

"Engineering" includes the cost of giving line and grade, etc.

"Adit proportion" is a proportionate charge per foot of tunnel to defray the cost of an adit from the surface to the tunnel line.

"Permanent equipment" costs were not segregated for each tunnel, but were compiled for the whole division, so the charge represents a proportionate charge per foot for the entire division cost, without salvage, of trolley and light lines, including freight and cost of installation; pressure air lines with freight and installation; ventilation lines with freight and installation; water lines with freight and installation; mine locomotives and cars, picks, shovels, drills and drill sharpeners, with repairs for the last four items.

## Tunnel 2, Length 1,739 Feet.

(Through medium-hard but very wet granite at an average speed of 170 feet per month.)

	Cost per foot of tunnel.
Excavation .....	\$ 8.81
Engineering .....	.19
Adit proportion .....	.34
Permanent equipment .....	2.35
Timbering (1,590 feet) .....	3.28
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	\$14.97

## Tunnel 2-A, Length 1,322 Feet.

(Through medium-hard granite at an average speed of 150 feet per month.)

	Cost per foot of tunnel.
Excavation .....	\$ 8.05
Engineering .....	.16
Adit proportion .....	.34
Permanent equipment .....	2.35
Timbering (1,322 feet) .....	2.51
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	\$13.41

## Tunnel 3-N for 1,148 Feet.

(Through medium-hard granite at an average speed of 150 feet per month.)

	Cost per foot of tunnel.
Excavation .....	\$10.10
Engineering .....	.23
Adit proportion .....	.51
Permanent equipment .....	2.35
Timbering (956 feet) .....	2.44
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	\$15.63

## Tunnel 3-S for 1,358 Feet.

(Through granite of variable hardness and containing pockets of carbon-dioxide gas, at an average speed of 155 feet per month.)

	Cost per foot of tunnel.
Excavation .....	\$12.38
Engineering .....	.28
Adit proportion .....	.16
Permanent equipment .....	2.35
Timbering (1,244 feet) .....	3.28
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	\$18.45