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QUARRY ACCIDENTS

IN THE
UNITED STATES

DURING THE CALENDAR YEAR

1936

BY

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QUARRY ACCIDENTS IN THE UNITED STATES DURING THE CALENDAR YEAR 1936¹

By WILLIAM W. ADAMS² AND VIRGINIA E. WRENN³

INTRODUCTION

The stone-quarrying and related industries of the United States made large gains in employment in 1936 over 1935, according to reports furnished by operating companies to the Bureau of Mines, United States Department of the Interior. Not only were more men employed, but also increases were made in the number of man-days of labor performed and in the number of man-hours worked in 1936. The increase in employment, however, was accompanied by an increase in the number of accidental deaths and injuries among the workers and by a slight increase in the accident-frequency rate per million man-hours worked. The fact that the larger number of accidents resulted in only a slight increase in the accident rate is explained by the large gain made in the number of man-hours worked during 1936. The accident rate in 1936, although higher than in 1935, was the lowest and therefore the best that the industry has experienced in any previous year except 1932 since complete and comparable figures first became available in 1916, a period of 21 years.

Operators' reports to the Bureau of Mines showed that the industry as a whole employed an average of 80,022 men in 1936 and that the men worked a total of 18,874,254 man-days or 147,064,448 man-hours. Accidents in and about the plants caused 91 deaths and 5,717 nonfatal lost-time injuries among the workers. The number of injuries and deaths represented an accident-frequency rate of 39.5 per million man-hours worked, compared with a rate of 38.2 in 1935.

A major disaster occurred on November 30, 1936, at a quarry in Delta, Pa., in which seven men were killed (two men were not quarry employees) by an explosives accident.

Pennsylvania, Ohio, California, and New York led all other States in the number of men employed. States having the fewest accidents in proportion to the number of man-hours of exposure to risk were Michigan, Iowa, Kansas, and Alabama. The highest accident rates for States in which the industry employed 1,000 or more men were those for Wisconsin, Washington, Virginia, and California, in the order stated. The relative standing of the States is shown in table 1. The greatest progress in lowering their accident-frequency rates in 1936, compared with 1935, was achieved by North Carolina and West Virginia, as shown in table 2.

¹ Work on manuscript completed July 1938. H. Lucile Sims assisted in the preparation of the statistical tables herein presented.

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The statistics of accidents and employment for 1936 covered 1,986 plants in 46 States, while those for 1935 covered 2,076 plants in 46 States and the District of Columbia. The two States in which no commercial quarries were active, or at least from which no plants reported, were Mississippi and North Dakota.

Of the 91 deaths that resulted from accidents, 48 occurred at open quarries and were caused chiefly by explosives and by falls or slides of rock or overburden, 5 occurred at underground quarries or mines, and 38 occurred at crushers, mills, or rock-dressing plants outside the quarries and were due chiefly to machinery, falls of persons, and falling objects.

Similarly, the reports of nonfatal lost-time injuries showed that, of the 5,717 accidents that occurred during the year, 3,237 were at open quarries and resulted mainly from handling materials, flying objects, falls or slides of rock or overburden, falls of persons, machinery, haulage, and hand tools. Underground quarries or mines reported 297 injuries, the largest number being due to loading rock, haulage equipment, and falls of rock from roof or wall. Mills and other works outside the quarries had 2,183 injuries, chiefly caused by handling materials, machinery, flying objects, and falls of persons.

The exact accident-severity rate for quarrying and related work in the United States cannot be given for the entire industry without a full and detailed report of each accident that occurred. Manifestly a system of reporting the full particulars of each injury would be too elaborate and costly in as widespread an industry as quarrying. However, the severity rate for the industry as a whole may be estimated with sufficient accuracy for accident-prevention purposes by assigning to each class of injury a specific charge in time lost or length of disability of the injured employees on the basis of full and complete reports from numerous companies operating in various parts of the country. Such reports are received from companies that have participated in annual safety contests conducted by the Bureau of Mines. These contests, known as the National Safety Competition, provide the Bureau with reports showing, among other things, the length of time each injured employee was disabled. Reports for the past few years show that employees receiving temporary injuries lost an average of 24 days from their work. Reports covering permanent partial disability reveal an average of 1,070 days lost per employee, the specific charge for each injury of this class being determined by the nature of the injury and the part of the body affected. Deaths and permanent total injuries were assigned a specific charge of 6,000 lost days each, in accordance with national standards for weighting industrial injuries of those two classes. Application of these time-loss charges to the 5,808 injuries and deaths that occurred during 1936 reveals a period of disability of 909,882 man-days, or an average of 6.19 days lost per thousand man-hours of employment or exposure to risk. The corresponding accident-severity rate for 1935 was 5.23. The difference between the two rates was due chiefly to an increase in the number of fatal accidents in 1936.

TABLE 1.—Relative standing of States having 1,000 or more men employed at quarries, including outside works, classified according to number of men employed, and fatality and injury rates per million man-hours of employment during the year ended Dec. 31, 1936

Relative standing	State	Number of men employed	Relative standing	State	Fatality rates	Relative standing	State	Injury rates
1	Pennsylvania	13,303	1	Vermont	-----	1	Michigan	14.11
2	Ohio	5,267	2	West Virginia	-----	2	Iowa	16.29
3	California	5,139	3	Minnesota	-----	3	Kansas	20.92
4	New York	4,380	4	Wisconsin	-----	4	Alabama	21.42
5	Missouri	4,104	5	Georgia	0.24	5	West Virginia	23.05
6	Illinois	4,088	6	Texas	.28	6	Ohio	28.02
7	Indiana	3,986	7	Massachusetts	.32	7	New York	30.08
8	Michigan	3,120	8	Iowa	.36	8	Pennsylvania	30.12
9	Virginia	2,855	9	California	.39	9	Tennessee	31.94
10	Tennessee	2,650	10	Indiana	.44	10	Indiana	35.24
11	Vermont	2,244	11	Michigan	.47	11	Texas	36.21
12	Georgia	2,122	12	Alabama	.50	12	Georgia	36.92
13	Texas	1,884	13	Virginia	.53	13	North Carolina	40.74
14	West Virginia	1,801	14	New York	.56	14	Kentucky	43.61
15	Alabama	1,770	15	Ohio	.58	15	Massachusetts	44.11
16	Massachusetts	1,654	16	Tennessee	.58	16	Minnesota	46.23
17	Iowa	1,573	17	Maine	.58	17	Illinois	46.48
18	Kansas	1,529	18	Missouri	.76	18	Maine	46.66
19	Kentucky	1,443	19	Pennsylvania	.82	19	Vermont	47.72
20	Wisconsin	1,436	20	Illinois	.88	20	Missouri	53.56
21	Minnesota	1,379	21	Kentucky	.88	21	California	59.11
22	Maine	1,369	22	North Carolina	.99	22	Virginia	63.44
23	Washington	1,268	23	Kansas	1.84	23	Washington	73.29
24	North Carolina	1,021	24	Washington	2.77	24	Wisconsin	74.70
	United States, total	80,022		United States, average	.62		United States, average	38.87

TABLE 2.—Percentage by which each State's accident-frequency rate (deaths and injuries) per million man-hours of employment in quarrying and related industries decreased or increased in 1936 compared with 1935

State	Number of accidents per million man-hours in 1936	Decrease compared with 1935, percent	State	Number of accidents per million man-hours in 1936	Increase compared with 1935, percent
North Carolina	41.73	-43.5	Kansas	22.76	+0.8
West Virginia	23.05	-33.9	Tennessee	32.52	+1.1
Massachusetts	44.43	-18.2	Iowa	16.65	+2.2
Ohio	28.60	-18.0	Virginia	63.97	+2.5
Wisconsin	74.70	-17.1	Indiana	35.68	+7.5
New York	30.64	-16.8	California	59.50	+11.3
Texas	36.49	-14.7	Minnesota	46.23	+16.3
Vermont	47.72	-13.3	Maine	47.24	+19.4
Michigan	14.58	-7.3	Missouri	54.32	+19.5
Kentucky	44.49	-7.1	Pennsylvania	30.94	+20.2
			Illinois	47.36	+24.6
			Washington	76.06	+29.7
			Georgia	37.16	+48.0
			Alabama	21.92	+59.9
			United States, average	39.49	+3.4

TABLE 3.—*Accident-frequency rates per million man-hours of employment in the quarrying industry in the United States, 1935 and 1936*

Kind of quarry	At quarries			At outside works			Total		
	1935	1936	Percent change in 1936	1935	1936	Percent change in 1936	1935	1936	Percent change in 1936
Cement rock.....	17.53	31.77	+81.2	8.28	11.35	+37.1	9.53	14.49	+52.0
Granite.....	71.05	64.21	-9.6	31.56	35.81	+13.5	54.57	52.23	-4.3
Limestone.....	61.92	62.35	+7	40.21	40.60	+1	54.72	54.99	+5
Limestone (chief product, lime).....	77.19	74.38	-3.7	36.65	41.94	+14.4	52.47	54.72	+4.3
Marble.....	58.57	53.03	-9.5	37.92	32.75	-13.6	44.07	37.60	-14.7
Sandstone.....	90.07	54.53	-39.5	28.37	36.63	+29.1	65.89	48.19	-26.9
Slate.....	87.00	76.68	-11.9	34.06	40.55	+19.1	54.89	53.17	-3.1
Traprock.....	60.74	65.15	+7.3	42.77	51.48	+20.4	53.60	60.33	+12.6
Total.....	62.05	60.03	-3.3	22.14	25.44	+14.9	38.19	39.49	+3.4

ACKNOWLEDGMENTS

The Bureau of Mines gratefully acknowledges the cooperation of the quarry operators throughout the United States, whose voluntary reports of accidents and employment form the basis of the tables in this bulletin.

SCOPE OF STATISTICS

The tables in this bulletin have been compiled by the Bureau of Mines from reports received directly from operators of quarries, and they represent all stages of the quarrying industry. The total figures are based on returns representing 1,986 quarries that were worked all or part of the year. The figures also cover crushing and screening, rock dressing, and the manufacture of lime and cement insofar as those operations are conducted by the quarry companies.

The Bureau of Mines is authorized to collect data on accidents at mines and quarries, but there is no Federal law that compels operators to supply such data; hence the reports received from operators are voluntary responses to the Bureau's requests for information. Although the figures presented herein may not be complete for the entire industry, every effort has been exerted to make them so, and the figures given are believed to be thoroughly representative of the hazards to which quarry workers are exposed. Moreover, the figures are comparable as between States, a fact extremely significant in view of the lack of uniformity among the States as regards classes of plants covered by State records, classes of accidents covered by State laws, and other factors that tend to make impracticable or impossible comparison of the accident experience of one State with that of another or comprehension of the relative importance of the various causes of accidents in the industry as a whole.

CLASSIFICATION OF QUARRIES

The quarries covered by this report have been classified according to the kind of rock produced, as follows: Cement rock, limestone, marble, sandstone, slate, trap rock, and granite. Separate statistical tables are presented for each group and for all groups combined. Clay, sand, and gravel pits are not included.

CLASSIFICATION OF INJURIES

From 1915 to 1929 the Bureau's statistics of accidents at quarries divided all injuries into five classes as follows: (1) Fatalities, (2) permanent total disabilities, (3) permanent partial disabilities, (4) temporary disabilities lasting more than 14 days, and (5) temporary disabilities lasting more than the remainder of the day on which the accident occurred but not exceeding 14 days. Beginning with 1930 classes (4) and (5) were consolidated under the general class of temporary injuries.

Figures covering accidents at quarries for the 5-year period 1932-36 are given in table 32, page 56.

DEFINITION OF ACCIDENT RATES

All accident rates shown in this publication, except where otherwise stated, have been calculated on the basis of a million man-hours of employment or exposure to risk.

QUARRY ACCIDENTS IN THE UNITED STATES, 1936

TABLE 4.—All quarries: Number of active quarries, men employed, and man-days, during the year ended Dec. 31, 1936

State	Number of active quarries ¹	Men employed					Man-days of employment					Total						
		At quarry		At outside works			At quarry		At outside works									
		Open quarry	Underground quarry	Crusher	Lime-kiln	Cement mill	Gran-ules and flour plant	Rock-dress-ing plant	Mis-cellaneous	Total	Open quarry		Underground quarry	Crusher	Lime-kiln	Cement mill	Gran-ules and flour plant	Rock-dress-ing plant	Mis-cellaneous	Total
Alabama.....	28	703	69	68	193	533	130	74	1,770	189,824	16,285	16,442	63,905	179,664	---	32,625	16,397	514,742
Arizona.....	6	70	---	11	31	104	24	156	28,018	28,018	---	2,212	9,180	---	---	---	8,077	42,497
Arkansas.....	6	90	---	15	30	104	4	246	29,983	29,983	---	3,984	10,980	31,280	406	---	---	147,822
California.....	98	2,483	261	331	1,443	1,162	277	5,139	578,711	82,835	82,835	81,796	45,651	472,084	2,665	52,200	62,189	1,378,091
Colorado.....	31	381	31	97	116	78	7	633	60,773	5,363	7,076	4,189	2,816	48,928	---	21,736	1,399	147,822
Connecticut.....	28	284	---	27	27	116	91	675	100,973	46,989	21,687	40,989	10,070	27,492	---	2,700	3,378	100,518
Florida.....	30	786	34	260	52	185	10	2,122	101,975	5,177	61,441	9,124	01,170	480	180,444	3,251	503,089	
Georgia.....	12	132	---	62	56	85	3	789	451,865	---	6,748	6,748	15,319	19,873	---	1,098	35,349	882,190
Illinois.....	73	2,064	82	311	1,002	8	169	4,088	451,000	21,540	146,775	15,641	303,905	---	255,040	42,230	371,634	349,606
Indiana.....	83	1,337	---	147	81	907	32	1,559	187,884	11,198	24,827	58,194	24,292	232,003	---	13,400	11,806	354,863
Iowa.....	37	646	51	188	646	43	21	1,423	151,465	11,198	24,827	58,194	24,292	232,003	---	13,400	11,806	354,863
Kansas.....	47	909	120	165	176	176	45	1,487	106,898	21,671	28,725	833	66,363	---	2,839	7,021	276,945	
Kentucky.....	3	59	---	16	82	---	17	187	106,898	---	28,725	833	66,363	---	2,839	7,021	276,945	
Louisiana.....	7	468	45	28	120	82	44	1,391	168,804	9,645	6,748	6,748	19,873	---	22,950	6,180	223,928	
Maine.....	38	473	2	110	21	211	8	69	101,800	9,645	23,129	23,129	41,038	---	1,848	20,828	197,791	
Maryland.....	58	929	4	101	71	211	340	67,654	210,800	744	44,866	22,014	41,038	---	6,632	26,206	385,552	
Massachusetts.....	26	963	2	363	31	464	3	1,205	407,654	476	79,833	10,290	407,654	---	827	78,909	805,788	
Michigan.....	40	510	---	84	33	905	565	1,374	69,292	8,683	8,683	10,290	56,012	---	152,705	13,688	329,701	
Minnesota.....	97	1,881	433	382	420	832	109	4,104	277,317	98,796	78,578	141,313	291,526	---	35,172	13,688	914,500	
Missouri.....	17	119	---	18	68	---	4	204	11,677	---	6,377	1,375	22,145	---	824	---	114,474	
Montana.....	10	187	23	23	195	---	17	222	31,677	---	6,377	1,375	22,145	---	824	---	114,474	
Nebraska.....	17	119	---	18	68	---	4	204	11,677	---	6,377	1,375	22,145	---	824	---	114,474	
New Hampshire.....	9	88	---	3	195	---	131	222	31,677	---	6,377	1,375	22,145	---	824	---	114,474	
New Jersey.....	31	386	---	160	12	343	14	604	89,846	---	28,852	3,152	91,581	---	19,837	5,630	312,336	
New Mexico.....	5	70	---	15	6	---	11	102	34,615	---	2,639	3,152	91,581	---	19,837	5,630	312,336	
New York.....	135	1,952	24	721	105	1,273	65	2,977	301,644	6,600	142,008	24,302	302,538	6,821	10,166	45,019	928,101	
North Carolina.....	21	622	---	155	105	3	297	4,380	143,000	---	142,008	24,302	302,538	6,821	10,166	45,019	928,101	
Ohio.....	137	1,874	158	613	758	1,172	351	5,087	420,283	33,437	131,948	231,099	391,330	6,612	53,239	6,080	240,484	
Oklahoma.....	21	314	---	81	46	370	2	680	62,631	---	131,948	231,099	391,330	6,612	53,239	6,080	240,484	
Oregon.....	19	161	---	114	6	370	3	680	62,631	---	131,948	231,099	391,330	6,612	53,239	6,080	240,484	
Pennsylvania.....	326	4,227	772	1,226	589	4,320	901	13,303	924,003	190,558	8,603	143,293	184,970	18,586	223,023	308,642	3,975,917	
Rhode Island.....	11	102	---	10	3	---	1	226	22,853	---	2,560	3,490	143,293	18,586	17,386	6,099	53,212	
South Carolina.....	6	154	---	121	3	---	34	309	36,384	---	27,776	3,490	143,293	18,586	17,386	6,099	73,506	

South Dakota.....	16	275	---	37	3	61	---	52	42	470	38,460	---	5,441	1,050	13,664	---	11,926	6,256	76,797
Tennessee.....	46	859	158	180	211	592	---	566	84	2,650	168,533	---	39,642	65,875	138,042	---	163,482	20,782	636,018
Texas.....	33	512	---	173	34	966	---	49	150	1,884	106,895	---	37,822	9,088	254,393	---	11,099	41,438	460,735
Utah.....	12	82	---	17	12	70	---	---	---	181	18,825	---	4,534	2,309	20,830	---	---	---	46,548
Vermont.....	44	1,001	125	17	35	---	83	980	10	2,244	243,148	---	1,994	12,759	92,109	17,103	262,741	2,770	577,001
Virginia.....	70	436	9	840	293	343	13	186	235	2,855	335,247	---	78,175	91,551	32,408	---	2,482	60,979	695,972
Washington.....	52	587	---	131	76	408	---	56	10	1,268	104,407	---	20,357	20,780	128,701	---	13,332	2,669	290,246
West Virginia.....	33	813	217	254	97	277	---	26	117	1,801	189,428	---	55,691	30,816	76,078	---	4,919	31,684	451,168
Wisconsin.....	78	886	---	167	44	98	---	215	26	1,436	152,386	---	23,452	13,582	26,395	---	40,932	5,719	262,466
Wyoming.....	7	57	35	24	---	88	---	---	---	204	8,569	---	8,253	---	26,976	---	---	---	49,125
Other States ¹	3	44	24	16	19	---	---	---	---	103	12,668	---	8,327	6,730	---	---	---	---	31,968
Total.....	1,986	82,951	2,686	8,373	3,635	20,152	264	8,041	3,920	80,022	6,835,305	659,299	1,752,684	1,071,876	5,641,433	56,938	1,885,157	971,562	18,874,254

¹ Includes a small number of mills or other plants not operated in connection with quarries.

² Includes Delaware and Nevada.

Tennessee.....	1, 402, 733	324, 173	316, 553	559, 590	1, 076, 047	1, 349, 573	169, 098	5, 197, 767	205	262	240
Texas.....	919, 844	-----	324, 125	72, 704	1, 855, 211	-----	301, 283	3, 562, 957	209	258	245
Utah.....	149, 800	-----	36, 171	18, 472	167, 040	-----	-----	371, 543	230	280	257
Vermont.....	1, 477, 095	291, 800	16, 703	99, 283	-----	147, 730	24, 930	4, 588, 872	248	266	244
Virginia.....	2, 883, 297	24, 168	686, 093	733, 175	517, 038	19, 857	518, 751	5, 674, 382	234	254	229
Washington.....	739, 831	-----	155, 093	166, 305	930, 460	-----	21, 286	2, 169, 400	178	273	261
West Virginia.....	1, 605, 839	454, 514	522, 319	237, 576	581, 206	-----	260, 421	3, 601, 307	238	267	251
Wisconsin.....	1, 235, 639	-----	197, 023	111, 240	211, 164	-----	44, 847	2, 115, 230	172	200	183
Wyoming.....	61, 266	66, 024	39, 963	-----	161, 858	-----	-----	329, 113	183	288	241
Other States ¹	97, 439	59, 986	38, 183	45, 568	-----	-----	-----	241, 196	309	314	310
Total.....	54, 580, 117	5, 176, 247	14, 450, 165	8, 307, 600	41, 215, 065	361, 172	7, 732, 813	147, 064, 448	210	256	236

¹ Includes Delaware and Nevada.

TABLE 6.—All quarries: Fatalities and injuries and rates per million man-hours, by States, during the year ended Dec. 31, 1936

State	Number killed					Number injured					Widows	Orphans	Rates per million man-hours					
	Open quarry	Underground quarry	Shaft or slope	Outside works	Total	Open quarry	Underground quarry	Shaft or slope	Outside works	Total			Killed			Injured		
													At quarry	At outside works	Total	At quarry	At outside works	Total
Alabama	1			1	2	48			37	85	1	1	0.61	0.43	0.50	29.45	15.82	21.42
Arizona						1				1						5.65		3.06
Arkansas						13			5	18						62.21	16.42	35.06
California	3	1			4	267	128	5	202	602	2	1	.81		.39	81.34	38.35	59.11
Colorado						25	5		25	55						64.87	43.28	52.88
Connecticut				1	2	39			21	60	1	1	1.94	3.06	2.38	75.78	64.16	71.26
Florida	4			4	4	24			4	28			4.42		2.38	26.49	5.14	16.63
Georgia				1	1	87			66	153	1	3		.39	.24	54.95	25.77	36.92
Idaho						3			12	15						29.67	71.64	55.84
Illinois	1				6	182	6		130	318	4		.30	1.42	.88	56.71	36.87	46.48
Indiana				3	3	106			134	240	2	1		.61	.44	56.32	27.19	35.24
Iowa				1	1	24			21	45				.49	.36	33.68	10.24	16.29
Kansas	2			3	5	21	9		27	57	3	5	1.89	1.80	1.84	28.38	16.19	20.92
Kentucky	2				2	83	3		13	99			1.36		.88	58.52	16.25	43.61
Louisiana						9			8	17						88.96	33.95	50.47
Maine		1			1	26	9		46	81			1.60		.59	56.03	41.39	46.66
Maryland	1			1	2	47	1		11	59	1		1.16	1.27	1.21	55.69	13.98	35.79
Massachusetts	1				3	77			61	138			.58		.32	44.76	43.30	44.11
Michigan	1			2	3	37			54	91	3	10	.55	.43	.47	20.35	11.66	14.11
Minnesota						56			66	122						73.95	35.08	46.23
Missouri			2	3	5	228	38	1	86	353	3	2	.70	.80	.76	94.11	22.91	53.56
Montana						13			3	16						95.58	14.43	46.53
Nebraska						4			4	8						14.07	7.62	9.89
New Hampshire						8			4	12						91.37	23.23	46.19
New Jersey	1			1	1	53			76	129		1	1.44		.57	76.38	71.94	73.70
New Mexico						3			1	4						20.48	32.74	22.59
New York	3			1	4	156	1		58	215	3	5	.96	.25	.56	60.45	14.37	30.08
North Carolina	2			2	2	62			20	82	1		1.66		.99	51.51	24.72	40.74
Ohio	2	1		3	6	164	3		124	291	5	10	.82	.45	.58	45.67	18.43	28.02
Oklahoma						54			44	98						107.09	43.53	64.69
Oregon	1			1	1	6			5	11			5.61		1.81	33.64	13.38	19.93
Pennsylvania	13			8	21	425	47		301	773	13	27	1.43	.48	.82	51.85	18.17	30.12
Rhode Island						8	1		6	15						42.35	26.73	34.33
South Carolina						53			10	63						165.16	29.87	96.08
South Dakota	1			1	1	9			10	19			3.18		1.70	28.66	36.35	32.25
Tennessee				3	3	85	9		72	166		7		.86	.58	54.43	20.74	31.94
Texas				1	1	70			59	129		1		.38	.28	76.10	22.32	36.21
Utah						9			12	21						60.06	54.13	56.52
Vermont						115	15		89	219						59.94	36.78	47.72
Virginia	3				3	247	4		109	360	2		1.03		.53	86.33	39.39	63.44
Washington	5			1	6	97			62	159	2		3.63	.72	2.77	122.86	44.93	73.29
West Virginia						47	7		29	83						27.55	17.67	23.05
Wisconsin						117			41	158						94.69	46.61	74.70
Wyoming						6	5		11	22						86.42	54.50	66.85
Other States ¹						23			4	27						146.08	47.76	111.94
Total	48	5	38	91	3,237	291	6	2,183	5,717	52	78	.89	.44	.62	59.14	25.00	38.87	

¹ Includes Delaware and Nevada.

TABLE 7.—Hours of employment per man per year worked at various places in quarries, 1936

State	Average hours of employment per man per year							Total	
	At quarry		At outside works						
	Open quarry	Under-ground quarry	Crusher	Lime-kiln	Cement mill	Gran-ules and flour plant	Rock-dressing plant		Miscel-laneous
Alabama.....	2, 124	1, 979	1, 992	2, 269	2, 543	-----	2, 123	1, 804	2, 242
Arizona.....	2, 531	-----	1, 513	2, 247	-----	-----	-----	2, 619	2, 399
Arkansas.....	2, 322	-----	1, 692	2, 928	1, 803	913	-----	-----	2, 113
California.....	1, 736	2, 310	1, 854	2, 617	2, 395	1, 777	1, 790	1, 723	1, 982
Colorado.....	1, 349	1, 384	1, 693	1, 516	1, 967	-----	-----	1, 866	1, 643
Connecticut.....	1, 812	-----	1, 917	906	-----	-----	1, 890	1, 631	1, 769
Florida.....	1, 752	-----	1, 985	2, 879	1, 896	-----	1, 800	656	1, 827
Georgia.....	1, 982	1, 218	2, 101	1, 354	2, 645	480	1, 830	1, 635	1, 953
Idaho.....	766	-----	568	851	1, 582	-----	400	2, 012	926
Illinois.....	1, 527	1, 998	1, 692	2, 231	1, 966	-----	1, 647	1, 371	1, 673
Indiana.....	1, 408	-----	1, 616	2, 029	2, 085	-----	1, 694	2, 601	1, 709
Iowa.....	1, 411	-----	1, 421	-----	1, 999	-----	1, 853	2, 052	1, 756
Kansas.....	1, 482	1, 953	1, 145	-----	2, 255	-----	2, 504	2, 016	1, 782
Kentucky.....	1, 411	1, 556	1, 488	1, 000	2, 552	-----	1, 510	1, 393	1, 573
Louisiana.....	1, 715	-----	1, 696	-----	1, 920	-----	-----	1, 801	1, 801
Maine.....	1, 170	1, 715	1, 340	2, 030	1, 784	-----	1, 110	1, 127	1, 268
Maryland.....	1, 812	1, 575	1, 645	2, 141	1, 568	2, 280	2, 695	2, 294	1, 790
Massachusetts.....	1, 845	1, 488	1, 942	2, 500	-----	2, 048	1, 783	2, 154	1, 892
Michigan.....	1, 883	2, 380	1, 847	2, 903	2, 227	872	-----	2, 063	2, 067
Minnesota.....	1, 468	-----	1, 322	2, 487	2, 537	-----	2, 127	997	1, 914
Missouri.....	1, 121	1, 681	1, 531	2, 421	2, 126	-----	2, 565	2, 201	1, 606
Montana.....	1, 143	-----	2, 534	2, 750	2, 500	-----	1, 318	-----	1, 686
Nebraska.....	1, 520	-----	2, 192	-----	2, 259	-----	-----	1, 987	1, 917
New Hampshire.....	995	-----	174	-----	-----	-----	1, 215	1, 252	1, 120
New Jersey.....	1, 802	-----	1, 747	2, 124	2, 174	-----	-----	1, 661	1, 936
New Mexico.....	1, 855	-----	1, 729	687	-----	-----	-----	248	1, 736
New York.....	1, 565	2, 200	1, 548	1, 897	1, 760	1, 914	1, 413	1, 602	1, 632
North Carolina.....	1, 926	-----	2, 067	-----	-----	1, 733	2, 040	1, 957	1, 971
Ohio.....	1, 820	1, 552	1, 781	2, 345	2, 122	-----	1, 918	2, 054	1, 972
Oklahoma.....	1, 606	-----	1, 384	-----	2, 273	-----	2, 195	2, 162	1, 913
Oregon.....	1, 078	240	566	1, 019	793	-----	1, 392	1, 056	812
Pennsylvania.....	1, 790	1, 994	1, 935	2, 016	1, 972	464	2, 139	2, 114	1, 929
Rhode Island.....	1, 883	2, 048	1, 735	2, 408	-----	-----	1, 987	2, 040	1, 934
South Carolina.....	2, 084	-----	1, 995	-----	-----	-----	-----	2, 749	2, 122
South Dakota.....	1, 142	-----	1, 194	2, 800	1, 344	-----	1, 835	1, 074	1, 253
Tennessee.....	1, 633	2, 052	1, 759	2, 652	1, 818	-----	2, 384	2, 013	1, 961
Texas.....	1, 797	-----	1, 879	2, 138	1, 921	-----	1, 812	2, 009	1, 891
Utah.....	1, 828	-----	2, 128	1, 539	2, 386	-----	-----	-----	2, 053
Vermont.....	1, 875	2, 335	1, 670	2, 837	-----	1, 780	2, 175	2, 493	2, 045
Virginia.....	2, 008	2, 685	2, 020	2, 502	1, 507	1, 527	1, 565	2, 207	1, 988
Washington.....	1, 345	-----	1, 184	2, 188	2, 281	-----	1, 906	2, 129	1, 711
West Virginia.....	1, 852	2, 095	2, 056	2, 449	2, 098	-----	1, 516	2, 226	2, 000
Wisconsin.....	1, 395	-----	1, 168	2, 528	2, 155	-----	1, 476	1, 725	1, 473
Wyoming.....	1, 075	1, 886	1, 665	-----	1, 839	-----	-----	-----	1, 613
Other States ¹	2, 215	2, 499	2, 386	2, 398	-----	-----	-----	-----	2, 342
Total.....	1, 656	1, 927	1, 726	2, 285	2, 045	1, 368	1, 895	1, 973	1, 838

¹ Includes Delaware and Nevada.

New Jersey.....	1																1						
New Mexico.....																							
New York.....							1		1														
North Carolina.....	1																					1	
Ohio.....								1															
Oklahoma.....																							
Oregon.....					1																		
Pennsylvania.....	2	1			7	2																	13
Rhode Island.....																							
South Carolina.....								1															
South Dakota.....																							
Tennessee.....																							1
Texas.....																							
Utah.....																							
Vermont.....																							
Virginia.....	2					1																	3
Washington.....	4					1																	5
West Virginia.....																							
Wisconsin.....																							
Wyoming.....																							
Other States ¹																							
Total.....	13	1			14	6	2	1	3	1	4						3	48	2			2	

¹ Includes Delaware and Nevada.

New York.....	4	39	23	2	8	13	6	10	4	11	19	1	1	156	32	50	14	6	35	2	20	25	8	
North Carolina.....	2	17	7	1	6	5	2	10	1	1	2	2	1	7	1	1	1	1	1	1	1	1	1	
Ohio.....	25	46	12	1	18	16	4	4	9	5	17	2	2	9	1	1	2	2	1	1	1	1	1	
Oklahoma.....	1	14	3	1	5	4	4	7	1	3	7	2	2	6	6	6	6	6	6	6	6	6	6	
Oregon.....	1	14	3	1	5	4	4	7	1	3	7	2	2	6	6	6	6	6	6	6	6	6	6	
Pennsylvania.....	49	146	19	14	34	50	9	33	1	24	22	1	1	20	7	7	1	1	7	4	7	3		
Rhode Island.....	1	22	2	1	4	4	2	3	1	1	3	1	1	1	8	1	1	1	1	1	1	1	1	
South Carolina.....	1	22	2	1	4	4	2	3	1	1	3	1	1	1	8	1	1	1	1	1	1	1	1	
South Dakota.....	18	16	6	6	6	6	5	15	3	3	6	1	1	1	9	1	1	1	1	1	1	1	1	
Texas.....	10	22	5	1	10	2	7	7	7	3	11	2	2	2	70	2	2	2	2	2	2	2	2	
Tennessee.....	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	
Utah.....	6	37	1	4	3	3	16	31	1	3	5	1	1	6	115	1	1	1	1	1	1	1	1	
Vermont.....	49	56	11	4	12	15	15	43	1	7	8	1	4	21	247	4	4	4	4	4	4	4	4	
Virginia.....	14	39	11	2	3	6	4	4	1	5	7	1	1	1	97	3	3	3	3	3	3	3	3	
West Virginia.....	3	12	1	1	7	8	1	7	1	6	6	1	1	2	47	3	3	3	3	3	3	3	3	
Wisconsin.....	6	42	7	3	8	5	2	10	1	7	11	1	1	15	117	3	3	3	3	3	3	3	3	
Wyoming.....	1	1	1	1	2	1	3	1	1	2	1	1	1	2	6	6	6	6	6	6	6	6	6	
Other States ¹	7	1	1	1	6	1	3	1	1	2	1	2	2	2	23	2	2	2	2	2	2	2	2	
Total.....	293	1,008	205	58	219	257	137	374	13	155	246	12	2	84	224	32	50	14	6	35	2	20	25	8

¹ Includes Delaware and Nevada.

QUARRY ACCIDENTS IN THE UNITED STATES, 1936

Ohio.....						1	3					18	23	3	1	18	8	19	14	9	11	124	291
Oklahoma.....														5		7	3	12	4	5	6	44	98
Oregon.....						4	47						1				10	23	68	15	45	301	773
Pennsylvania.....						1	1					1	1	1		1	2	1	1			6	15
Rhode Island.....																						10	63
South Carolina.....																						4	19
South Dakota.....																							19
Tennessee.....							9					5	2	2		5	5	6	34	6	4	72	166
Texas.....											4	9	2	1		5	10	5	3	3	10	4	29
Utah.....											2	1	2	1		6	5	10	5	3	4	72	129
Vermont.....											4	1	2	1		1	5	2	1	2	1	12	21
Virginia.....						3	4				5	16	12	1		7	11	5	27	2	17	89	219
Washington.....							15				5	10	12	2		10	7	11	16	8	20	109	360
West Virginia.....											3	14	4	1		11	5	5	12	1	7	62	159
Wisconsin.....							7				2	4	1	6		3	5	5	2	2	9	29	83
Wyoming.....							5				2	4	6			4	2	1	11	2	11	41	158
Other States ¹						1									1	3	2	1	4			11	27
Total.....						34	291			1	1	6	117	304	29	28	148	267	307	151	836	2,183	5,717

¹ Includes Delaware and Nevada.

TABLE 10.—All quarries: Accidents by States and severity of injury, during the year ended Dec. 31, 1936

State	Killed	Injured				Grand total
		Perma- nent total ¹	Perma- nent partial ²	Tempo- rary ³	Total non- fatal	
Alabama.....	2		8	77	85	87
Arizona.....				1	1	1
Arkansas.....				18	18	18
California.....	4	3	8	591	602	606
Colorado.....			2	53	55	55
Connecticut.....	2		3	57	60	62
Florida.....	4		1	27	28	32
Georgia.....	1		5	148	153	154
Idaho.....			1	14	15	15
Illinois.....	6		7	311	318	324
Indiana.....	3		3	237	240	243
Iowa.....	1		3	42	45	46
Kansas.....	5	1	3	53	57	62
Kentucky.....	2			99	99	101
Louisiana.....				17	17	17
Maine.....	1		3	78	81	82
Maryland.....	2		3	56	59	61
Massachusetts.....	1		1	137	138	139
Michigan.....	3		1	90	91	94
Minnesota.....			3	119	122	122
Missouri.....	5		2	351	353	358
Montana.....			1	15	16	16
Nebraska.....				8	8	8
New Hampshire.....				12	12	12
New Jersey.....	1		8	121	129	130
New Mexico.....				4	4	4
New York.....	4		10	205	215	219
North Carolina.....	2		4	78	82	84
Ohio.....	6	1	6	284	291	297
Oklahoma.....			5	93	98	98
Oregon.....	1			11	11	12
Pennsylvania.....	21	2	18	753	773	794
Rhode Island.....				15	15	15
South Carolina.....			2	61	63	63
South Dakota.....	1		1	18	19	20
Tennessee.....	3		5	161	166	169
Texas.....	1	1	9	119	129	130
Utah.....				21	21	21
Vermont.....			10	209	219	219
Virginia.....	3		16	344	360	363
Washington.....	6		9	150	159	165
West Virginia.....			5	78	83	83
Wisconsin.....			3	155	158	158
Wyoming.....				22	22	22
Other States ⁴			2	25	27	27
Total.....	91	8	171	5,538	5,717	5,808

¹ Permanent total disability: Loss of both legs or arms, 1 leg and 1 arm, total loss of eyesight, paralysis, or other condition permanently incapacitating workman from doing any work of a gainful occupation.

² Permanent partial disability: Loss of 1 foot, leg, hand, or eye, 1 or more fingers, 1 or more toes, any dislocation where ligaments are severed, or any other injury known in surgery to be permanent partial disability.

³ Disability for more than remainder of day of accident.

⁴ Includes Delaware and Nevada.

TABLE 11.—All quarries: Accidents, by causes and severity of injury, during the year ended Dec. 31, 1936

Cause	Killed	Injured				Grand total
		Perma- ment total ¹	Perma- ment partial ²	Tempo- rary ³	Total non- fatal	
OPEN QUARRY						
1. Falls or slides of rock or overburden.....	13		12	281	293	306
2. Handling materials:						
(a) Handling rock at face.....	1		15	812	827	828
(b) Handling other material.....			3	178	181	181
3. Hand tools.....			7	198	205	205
4. Explosives:						
(a) Transportation.....				4	4	4
(b) Charging.....	6		2	3	5	11
(c) Drilling into old holes.....	1			11	11	12
(d) Striking in loose rock.....						
(e) Thawing.....						
(f) Caps, detonators, etc.....	5		4	2	6	11
(g) Unguarded shots.....				2	2	2
(h) Returned too soon.....			1	2	3	3
(i) Premature shots.....	1		1	2	3	4
(j) Delayed blast.....	1			2	2	3
(k) Miscellaneous.....		1		21	22	22
5. Haulage:						
(a) Hand and animal.....			1	54	55	55
(b) Mechanical.....	3		2	81	83	86
(c) Railway cars and locomotives.....	3	1	7	73	81	84
6. Falls of persons:						
(a) Falling into quarry from surface benches or face.....	2		3	53	56	58
(b) Falling from hoists, derricks, ladders, etc.....				47	47	47
(c) Miscellaneous.....				154	154	154
7. Falling objects (other than 1 and 2)....	1	1	7	129	137	138
8. Flying objects:						
(a) From sledging.....			6	235	241	241
(b) Others.....			2	131	133	133
9. Electricity:						
(a) Direct contact with trolley wire.....			1		1	1
(b) Bar or tool striking trolley wire.....	1					1
(c) Contact with motor.....						
(d) Others.....	2			12	12	14
10. Drilling and channeling (by machine or hand).....	1	1	5	149	155	156
11. Machinery:						
(a) Hoisting cables and attachments.....		1	1	45	47	47
(b) Guys, cranes, derricks, and attachments.....				34	34	34
(c) Pumps and hoisting engines.....				3	3	3
(d) Power shovels.....	1		8	62	70	71
(e) Other machinery.....	3		4	88	92	95
12. Stepping on nail.....				12	12	12
13. Boiler and air-tank explosions.....				2	2	2
14. Burns.....				34	34	34
15. Other causes.....	3		4	220	224	227
Total, at open quarry.....	48	5	96	3, 136	3, 237	3, 285

¹ Permanent total disability: Loss of both legs or arms, 1 leg and 1 arm, total loss of eyesight, paralysis, or other condition permanently incapacitating workman from doing any work of a gainful occupation.

² Permanent partial disability: Loss of 1 foot, leg, hand, or eye, 1 or more fingers, 1 or more toes, any dislocation where ligaments are severed, or any other injury known in surgery to be permanent partial disability.

³ Disability for more than remainder of day of accident.

TABLE 11.—All quarries: Accidents, by causes and severity of injury, during the year ended Dec. 31, 1936—Continued

Cause	Killed	Injured				Grand total
		Perma-ment total	Perma-ment partial	Tempo-rary	Total non-fatal	
UNDERGROUND						
1. Fall of rock from roof or wall.....	2		1	31	32	34
2. Rock while loading at working face or chute.....				59	59	59
3. Hand tools.....				14	14	14
4. Explosives.....		1	1	4	6	6
5. Haulage.....	2		2	33	35	37
6. Falling down chute, winze, raise, or slope.....				2	2	2
7. Run of rock from chute or pocket.....				20	20	20
8. Drilling.....				25	25	25
9. Electricity.....						
10. Machinery (other than locomotives or drills).....				8	8	8
11. Mine fires.....						
12. Suffocation from natural gases.....						
13. Inrush of water.....						
14. Stepping on nail.....				34	34	34
15. Handling materials (other than rock).....				56	56	57
16. Other causes.....	1					
Total, at underground quarry.....	5	1	4	286	291	296
SHAFT OR SLOPE						
17. Falling down shaft or slope.....				1	1	1
18. Objects falling down shaft or slope.....				1	1	1
19. Breaking of cables.....						
20. Overwinding.....						
21. Cage, skip, or bucket.....						
22. Other causes.....				4	4	4
Total, in shaft or slope.....				6	6	6
OUTSIDE WORKS						
1. Haulage:						
(a) Hand and animal.....			1	24	25	25
(b) Mechanical.....	2		5	26	31	33
(c) Railway cars and locomotives.....	2		5	56	61	63
2. Machinery:						
(a) Hoisting cables and attachments.....	2		3	40	43	45
(b) Guys, cranes, derricks, and attachments.....	1		1	32	33	34
(c) Pumps and hoisting engines.....			2	10	12	12
(d) Crushers.....	2		2	49	51	53
(e) Other machinery.....	6		15	150	165	171
3. Hand tools.....	1		6	165	171	172
4. Stepping on nail.....				29	29	29
5. Electricity:						
(a) Direct contact with trolley wire.....				7	7	7
(b) Bar or tool striking trolley wire.....						
(c) Contact with motor.....						
(d) Others.....	3			21	21	24
6. Falls of persons.....	5	1	2	232	235	240
7. Falling objects (rocks, timbers, etc.).....	5	1	7	140	148	153
8. Flying objects:						
(a) From sledging.....			5	84	89	89
(b) From crushing.....			1	32	33	33
(c) Others.....			2	143	145	145
9. Handling materials:						
(a) Handling rock by hand.....			2	204	206	206
(b) Handling other materials.....	2		5	186	191	193
10. Burns.....			1	150	151	151
11. Other causes.....	7		6	330	336	343
Total, at outside works.....	38	2	71	2, 110	2, 183	2, 221
Grand total.....	91	8	171	5, 538	5, 717	5, 808

TABLE 12.—All quarries: Causes of fatalities and injuries, showing percentage due to each cause and corresponding rates per million man-hours, during the year ended Dec. 31, 1936

Cause of accident	Fatalities				Nonfatal injuries			
	Percent of—		Per million man-hours		Percent of—		Per million man-hours	
	Grand total	Class total	Grand total	Class total	Grand total	Class total	Grand total	Class total
	1	2	3	4	5	6	7	8
Open quarry:								
1. Falls or slides of rock or overburden	14.28	27.09	0.088	0.238	5.13	9.05	1.992	5.368
2. Handling materials	1.10	2.08	.007	.018	17.63	31.14	6.854	18.468
3. Hand tools					3.59	6.33	1.394	3.756
4. Explosives	15.38	29.17	.095	.257	1.01	1.79	.394	1.063
5. Haulage	6.59	12.50	.041	.110	3.83	6.77	1.489	4.012
6. Falls of persons	2.20	4.17	.014	.037	4.50	7.94	1.747	4.709
7. Falling objects (other than 1 and 2)	1.10	2.08	.007	.018	2.40	4.23	.932	2.510
8. Flying objects					6.54	11.56	2.543	6.852
9. Electricity	3.30	6.25	.020	.055	.23	.40	.088	.238
10. Drilling and channeling (by machine or hand)	1.10	2.08	.007	.018	2.71	4.79	1.054	2.840
11. Machinery	4.40	8.33	.027	.073	4.30	7.60	1.673	4.507
12. Stepping on nail					.21	.37	.082	.220
13. Boiler and air-tank explosions					.03	.06	.014	.037
14. Burns					.59	1.05	.231	.623
15. Other causes	3.30	6.25	.020	.055	3.92	6.92	1.523	4.104
Total	52.75	100.00	.326	.879	56.62	100.00	22.010	59.307
Underground quarry:								
1. Fall or rock from roof or wall	2.20	40.00	.014	.386	.56	11.00	.218	6.182
2. Rock while loading at working face or chute					1.03	20.28	.401	11.398
3. Hand tools					.24	4.81	.095	2.705
4. Explosives					.11	2.06	.041	1.159
5. Haulage	2.20	40.00	.014	.386	.61	12.03	.238	6.762
6. Falling down chute, winze, raise, or slope					.04	.69	.014	.386
7. Run of rock from chute or pocket					.35	6.87	.136	3.864
8. Drilling					.44	8.59	.170	4.830
9. Electricity								
10. Machinery (other than locomotives or drills)					.14	2.75	.054	1.545
11. Mine fires								
12. Suffocation from natural gases								
13. Inrush of water								
14. Stepping on nail								
15. Handling materials (other than rock)					.59	11.68	.231	6.568
16. Other causes	1.10	20.00	.007	.193	.98	19.24	.381	10.819
Total underground (excluding shaft)	5.49	100.00	.034	.965	5.09	100.00	1.979	56.218
Shaft or slope:								
17. Falling down shaft or slope					.02	16.67	.007	.193
18. Objects falling down shaft or slope					.02	16.67	.007	.193
19. Breaking of cables								
20. Overwinding								
21. Cage, skip, or bucket					.07	66.66	.027	.773
22. Other causes								
Total shaft					.11	100.00	.041	1.159
Total underground (including shaft)	5.49	100.00	.034	.965	5.20	100.00	2.020	57.377

TABLE 12.—All quarries: Causes of fatalities and injuries, showing percentage due to each cause and corresponding rates per million man-hours, during the year ended Dec. 31, 1936—Continued

Cause of accident	Fatalities				Nonfatal injuries			
	Percent of—		Per million man-hours		Percent of—		Per million man-hours	
	Grand total	Class total	Grand total	Class total	Grand total	Class total	Grand total	Class total
	1	2	3	4	5	6	7	8
At outside works:								
1. Haulage.....	4.40	10.53	0.027	0.046	2.04	5.36	0.796	1.340
2. Machinery.....	12.09	28.95	.075	.126	5.32	13.93	2.067	3.482
3. Hand tools.....	1.10	2.63	.007	.012	2.99	7.83	1.163	1.959
4. Stepping on nail.....					.51	1.33	.197	.332
5. Electricity.....	3.30	7.89	.020	.034	.49	1.28	.190	.321
6. Falls of persons.....	5.49	13.16	.034	.057	4.11	10.76	1.598	2.692
7. Falling objects (rocks, timbers, etc.).....	5.49	13.16	.034	.057	2.59	6.78	1.006	1.695
8. Flying objects.....					4.67	12.23	1.816	3.058
9. Handling materials.....	2.20	5.26	.014	.023	6.94	18.19	2.699	4.547
10. Burns.....					2.64	6.92	1.027	1.729
11. Other causes.....	7.69	18.42	.048	.080	5.88	15.39	2.285	3.848
Total.....	41.76	100.00	.259	.435	38.18	100.00	14.844	25.003
Grand total.....	100.00	-----	.619	-----	100.00	-----	38.874	-----

ACCIDENTS AT DIFFERENT KINDS OF QUARRIES

Cement rock.—Although the cement industry maintained its leadership in safety among quarry operations in the United States in 1936, its own record for the year was not as good as in 1935. Employment improved, as gains were reported in the number of men employed and in the number of man-hours worked. Operating time per employee was also better, as the average employee worked 45 more days in 1936 than in 1935.

The total working force, or rather the average number of employees for the period during which the mills and quarries were active, comprised 26,004 men, an increase of more than 6 percent. The total working time for the entire force increased 32 percent, the volume of labor having risen from 39 million man-hours in 1935 to nearly 52 million man-hours in 1936. Reports for 1936 showed an average of 1,992 hours of work per employee and a weighted average of 7.3 hours per day per man, compared with 1,607 hours per employee and an average workday of 7.1 hours per man in 1935. Operations were reported by 178 plants in 35 States. Pennsylvania was easily the leading State in number of men working, having more than twice as many employees as California or New York which ranked second and third, respectively. These three States accounted for about a third of the total number of men employed at cement mills and quarries in all States during the year.

Accidents to the men while at work resulted in the death of 23 employees and the injury of 728; the principal causes were handling materials, falls of persons, machinery, flying objects, falling objects, burns, and hand tools. The accident-frequency rate increased to 14.49 per million man-hours worked from 9.53 in 1935; the higher rate

in 1936 was due chiefly to an increase in accidents at the quarries, although mill accidents also increased to some extent. The principal causes of the accidents are shown in table 14. (See tables 13, 14, 16, and 17.)

Granite.—Reports for 1936 showed a net reduction in the accident rate for the granite industry compared with 1935. The entire improvement was credited to operations in and about the quarries and was sufficient to overcome an increase in the accident rate for operations at rock-dressing plants or elsewhere outside the quarries. The industry also made gains in the number of men employed and larger gains in the total number of man-hours worked.

Reports from the operating companies revealed a total working force of 8,243 men and a total of 14.7 million man-hours of labor, the former representing an increase of 20 percent and the latter of 39 percent over the records for the preceding year. Men working at the quarries outnumbered those at the outside plants by a ratio of 1 to 0.7. Both classes of employees worked more days per man in 1936, the average for each group of workers being 224 days. Reports for 1936 covered 273 active plants in 27 States. The leading States in number of men working were California, Maine, North Carolina, Massachusetts, Georgia, and Vermont, in the order named.

Accidents resulted in 5 deaths and 763 lost-time injuries among the employees, representing an accident-frequency rate of 52.23 per million man-hours of work or exposure to hazards. The corresponding rate for 1935 was 54.57. Most of the accidents at the quarries were caused by handling materials, flying objects, machinery, falling objects, and drilling. Accidents to employees engaged on rock-dressing or other work outside the quarries were due chiefly to flying objects, handling materials, machinery, and hand tools. (See tables 13, 14, 18, and 19.)

Limestone.—There was virtually no change in the accident rate for the limestone industry in 1936. Reports covering the quarries, crushers, and finishing plants showed that accidents causing injury or death occurred at a rate of 54.99 per million man-hours of employment compared with 54.72 in 1935. Employment showed gains in the number of quarry workers and the number of men engaged on work outside the quarries. The total working force comprised 24,288 men, exclusive of those employed at plants whose chief product was cement or lime. The total number of man-hours of employment and the average number of workdays per man also increased. The number of man-hours worked by the entire industry was 38.4 millions, an increase of 34 percent over 1935, and the number of men employed increased between 6 and 7 percent. The average working time per employee was 194 days, or 1,579 hours, a weighted average of 8.1 hours per day. In the previous year each employee worked 159 days, or 1,257 hours with an average workday of 7.9 hours. These figures are based on operations at 861 plants in 42 States. Information for 26 of these States is given in tables 20 and 21. Pennsylvania, Indiana, and Illinois, in the order stated, employed more men than any other State. For the country as a whole, reports from the operators showed a little more than twice as many men employed at the limestone quarries as at the crushers and finishing plants, the ratio being 1 employee at the quarries to 0.45 employee outside the quarries.

Accidents at the quarries and outside plants resulted in 34 deaths and 2,075 injuries among the employees. As the total amount of employment or exposure to risk at all plants during the year was over 38 million man-hours, the number of fatalities and injuries represented an accident-frequency rate of 54.99 per million man-hours worked, as previously stated. Outstanding among the causes of accidents to the men who worked in and about the quarries were "handling materials"; other important causes were flying objects, falls or slides of rock or overburden, falls of persons, machinery, and haulage equipment. Accidents to men at crushers and rock-finishing plants were caused mainly by machinery, handling materials, flying objects, and falls of persons. (See tables 13, 14, 20, and 21.)

Marble.—A large increase in employment at marble quarries, as shown by reports from producers for 1936, occurred both in the number of men engaged in the quarrying and finishing of the stone and the number of man-hours of work performed. Substantial gains were also made in the number of workdays and workhours per employee during the year. Accidents to the employees increased in number but not in the same proportion as the increase in the number of workers; hence the accident-frequency rate was more favorable than in 1935.

Reports from producers showed a total working force of 3,304 men, of whom 932 worked in and about the quarries and 2,372 worked at the outside plants, chiefly on rock dressing. Labor performed during the year totaled 6.7 million man-hours, an average of 2,028 hours per man. The plants were active for an average of 251 days per employee, the weighted average length of shift being 8.1 hours compared with 7.8 hours in 1935. These figures cover the operations of 54 plants in 15 States; the principal marble-quarrying States were Vermont and Tennessee. (See table 16.)

Two men were killed and 250 men were injured by accidents at the quarries and outside plants, representing an accident-frequency rate of 37.60 per million man-hours worked compared with 44.07 in 1935. Two-thirds of the accidents occurred at the outside plants, the principal causes of accidents being handling materials, use of machinery, and falling objects. The main causes of accidents to the men working in and about the quarries were machinery and handling materials. (See tables 13, 14, 16, and 17.)

Limestone (chief product, lime).—Because of the importance of the lime industry, quarries whose output was used chiefly for the manufacture of lime are classed in this bulletin as a separate group, and separate figures for these quarries and their associated limekilns are presented. Employment showed gains both in number of employees and number of man-hours worked in 1936; but the accident-frequency rate for the group was slightly higher than in 1935. The number of men employed was 9,385, and their working time totaled 20.7 million man-hours, an average of 2,200 hours per man for the year. The plants were in operation for 281 days per man, a gain of 14 workdays per man over the preceding year. A slight lengthening of the workday was indicated by the reports, which showed a weighted average of 7.8 hours per day in 1936 compared with 7.6 hours per day in 1935. There were 222 plants in operation in 36 States; Pennsylvania and Ohio had larger numbers of employees than any other State.

Both the number of accidents and their ratio to the number of man-hours of labor performed increased in 1936; 12 men were killed (4 more than in 1935), and 1,118 men were injured (an increase of 257 over 1935), the combined rate for 1936 being 54.72 per million man-hours worked compared with 52.47 in 1935. Accidents at the quarries were due chiefly to handling materials, falls or slides of rock or overburden, flying objects, and haulage; injuries to men employed at the limekilns or elsewhere outside the quarries were caused mainly by handling materials, burns, flying objects, and machinery. (See tables 13, 14, 22, and 23.)

Sandstone.—Outstanding among the achievements of the sandstone industry in 1936 was the progress made in the prevention of accidents, as indicated by a reduction in the accident-frequency rate from 65.89 per million man-hours in 1935 to 48.19 in 1936. The accident rate among workers in and about the quarries was reduced 39 percent, which more than canceled an increase of 29 percent in the rate for accidents at rock-dressing and other outside plants and made a net reduction of 27 percent in the combined rate for both groups of employees. The actual number of men injured in 1936 was 249, including 1 man killed. Most of the accidents at the quarries were chargeable to handling materials, hand tools, falls of persons, and flying objects. Machinery was the principal cause of accidents to men working outside the quarries. The reduction in the accident rate was due chiefly to a decline in the rates for accidents caused by handling materials, flying objects, and falls or slides of rock or overburden.

Employment was better in 1936 than in 1935, whether measured by the number of men employed or by the number of man-hours worked. The employees totaled 3,122, of whom 2,119 worked at the quarries and 1,003 at the outside plants, and the working time for all employees was 5.2 million man-hours, an increase of 40 percent over 1935. Operations were conducted by 171 plants in 26 States, with Pennsylvania leading with the largest number of employees. Ranking after Pennsylvania were Ohio and West Virginia. For the industry as a whole, approximately two men were employed on quarrying work to every man employed on related work outside the quarries. (See tables 13, 14, 24, and 25.)

Slate.—An increase of 24 percent in the number of employees and an increase of 58 percent in the number of man-hours worked were reported for 1936 by operators of slate quarries in the United States. The number of men employed in 1936 was 2,565, of whom 907 worked at the quarries and 1,658 were employed on finishing or other work outside the quarries. The working time of the entire personnel was 4.9 million man-hours compared with 3.1 million man-hours in 1935. These figures covered 77 plants in 11 States. More than half of the total number of employees in the industry worked at plants in Pennsylvania. Vermont and Virginia ranked next in number of men employed.

Accidents caused by hazards incident to the work at the plants resulted in the death of 6 employees and in the injury of 254, thus indicating an accident-frequency rate of 53.17 per million man-hours worked compared with 54.89 in 1935. Although the net rate did not change materially, a substantial reduction was reported in the rate

of accidents to the quarry workers, which more than overcame an increase in the rate of accidents to employees working outside the quarries. Most of the accidents to the quarry workers and to the men working at the outside plants were due to handling materials. (See tables 13, 14, 16, and 17.)

Trap rock.—In contrast to all other classes of quarries covered by this publication, trap-rock quarries employed fewer men in 1936 than in 1935. The decline in the number of workers, however, did not result in a smaller volume of work during the year, as the quarries were in operation longer in 1936 than in 1935 and this resulted in a substantial increase in the number of man-hours worked. The number of men employed at all plants was 3,111, a reduction of 385 from the previous year's force, but the number of man-hours worked increased from 4.2 millions in 1935 to 4.8 millions in 1936, or 13 percent. The average employee worked 187 days or 1,540 hours during the year. The number of employees at the quarries outnumbered those outside the quarries by a ratio of approximately 1 to 0.6. Operations were reported by 150 plants in 17 States. Massachusetts was the leading State in number of employees, followed by New Jersey, Washington, and Pennsylvania.

Accidents increased in number and in proportion to the number of man-hours worked. In 1936, 8 men were killed and 281 men were injured, representing an accident-frequency rate of 60.33 per million man-hours compared with 53.60 in 1935. The most numerous class of accidents to men at the quarries was that chargeable to handling materials, followed by three classes which ranked equal in the number of injuries, namely, falls or slides of rock or overburden, haulage, and machinery. Machinery was the principal cause of accidents to men working outside the quarries; flying objects ranked second and handling materials third. (See tables 13, 14, 16, and 17.)

TABLE 13.—All quarries: Men employed, man-days, man-hours of employment, and number killed and injured, by kind of quarry, during the year ended Dec. 31, 1936

Kind of quarry	Number of quarries 1	Men employed			Man-days of employment			Average hours of employment per man per day			Man-hours of employment		
		At quarry works		Total	At quarry works		Total	At quarry works		Total	At quarry works		Total
		At quarry works	At out-side works	Total	At quarry works	At out-side works	Total	At quarry works	At out-side works	Total	At quarry works	At out-side works	Total
Cement rock.....	178	4,402	21,602	26,004	1,073,338	5,993,269	7,066,607	7.45	7.31	7.33	7,995,414	43,813,039	51,808,453
Granite.....	273	4,779	3,464	8,243	1,048,877	7,775,836	1,844,713	7.96	7.99	7.97	8,503,251	6,200,222	14,703,473
Limestone.....	861	16,743	7,545	24,288	3,197,701	1,578,890	4,706,595	8.11	8.22	8.15	25,374,123	12,978,862	38,352,985
Limestone (chief product, lime).....	222	3,777	5,008	8,785	1,007,652	1,594,578	2,632,230	7.84	7.85	7.84	8,134,208	12,516,668	20,650,876
Marble.....	54	3,932	2,372	6,304	493,052	632,770	828,722	8.16	8.06	8.09	1,602,717	5,098,903	6,701,620
Sandstone.....	171	2,119	1,003	3,122	409,095	219,499	628,598	8.16	8.33	8.22	3,337,562	1,829,066	5,166,628
Slate.....	77	907	1,638	2,545	203,540	382,482	586,022	8.20	8.32	8.34	1,708,431	3,181,389	4,889,820
Trap rock.....	150	1,978	1,133	3,111	378,163	202,326	580,489	8.20	8.35	8.25	3,100,658	1,689,935	4,790,593
Total.....	1,986	35,637	44,385	80,022	7,494,604	11,379,650	18,874,254	7.97	7.67	7.79	59,756,364	87,308,084	147,064,448

Kind of quarry	Average days of employment per man		Average hours per man per year		Number killed			Number injured			Rates per million man-hours		
	At quarry works		At out-side works		At quarry works		Total	At quarry works		Total	At quarry works		Total
	At quarry works	At out-side works	At quarry works	At out-side works	At quarry works	At out-side works	Total	At quarry works	At out-side works	Total	At quarry works	At out-side works	Total
Cement rock.....	244	277	1,816	2,028	6	17	23	480	17	28	0.75	0.39	0.44
Granite.....	224	224	1,779	1,790	5	34	39	222	3	0	.59	.34	.34
Limestone.....	187	209	1,516	1,720	21	13	34	541	15	15	1.00	1.00	.89
Limestone (chief product, lime).....	275	284	2,164	2,232	7	2	9	514	7	14	.86	.39	.68
Marble.....	210	267	1,720	2,130	2	2	4	598	2	8	.....	.....	.....
Sandstone.....	193	219	1,575	1,824	1	.....	1	165	0	0	.....	.....	.....
Slate.....	224	231	1,919	1,906	6	6	12	248	4	5	3.51	.....	1.23
Trap rock.....	191	179	1,568	1,492	7	1	8	195	4	8	2.26	.59	1.67
Total.....	210	256	1,677	1,967	53	38	91	3,634	2,183	5,717	.89	.44	.62

1 Includes a small number of mills or other plants not operated in connection with quarries.

TABLE 14.—All quarries: Fatalities and injuries, by causes and kind of quarry, during the year ended Dec. 31, 1936

Kind of quarry	Open quarry										Underground quarry																
	Falls or slides of rock or overburden	Handling materials	Hand tools	Explosives	Haulage	Falls of persons	Falling objects (other than 1 and 2)	Flying objects	Electricity	Drilling and channelling (by machine or hand)	Machinery	Stepping on nail	Boiler and air-tank explosions	Burns	Other causes	Total	Fall of rock from roof or wall	Rock while loading at working face or chute	Hand tools	Explosives	Haulage	Falling down chute, winze, raise, or slope	Run of rock from chute or pocket	Drilling	Electricity	Machinery (other than locomotives or drills)	
Killed:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15		1	2	3	4	5	6	7	8	9	10	
Cement rock				1	1		1		1		1					4					2						
Granite	2																										
Limestone	4	1		4	3	2	1		1		1				3	19	1										
Limestone (chief product, lime)	4			1					1		1					7											
Marble																											
Sandstone									1							1											
Slate					2						1					7											
Trap rock	2										1					7											
Total	13	1	14	6	2	1	1	3	1	4	3	48	2	2	3	48	2	2	2	2	2	2	2	2	2	2	2
Injured:	22	30	10	2	7	9	2	22	2	8	1	1	1	1	6	134	15	19	1	4	9	2	14	4	1	1	
Cement rock	20	156	27	5	19	37	42	77	2	40	3	3	3	6	57	540	4	26	1	17	17	8	3	13	1	2	
Granite	134	454	93	23	104	133	57	168	8	62	4	4	1	16	102	1,476	7	9	8	8	8	1	1	1	1	4	
Limestone	74	200	31	11	52	30	19	65	3	12	2	2	1	7	33	553	4	26	1	1	1	1	1	3	1	4	
Limestone (chief product, lime)	3	12	10	4	4	5	4	3	1	2	14	2	1	1	5	64	1	1	4	1	1	1	2	3	1	4	
Marble	11	51	21	3	11	17	4	15	1	10	13	1	1	2	8	166	1	1	4	1	1	1	2	2	1	4	
Sandstone	3	10	59	4	3	9	3	8	7	7	9	1	1	1	1	115	1	1	4	1	1	1	1	2	1	4	
Slate	10	59	4	14	19	17	8	16	10	19	1	1	1	1	9	189	1	1	1	1	1	1	1	2	1	1	
Trap rock	19	46	9	14	19	17	8	16	7	9	1	1	1	1	9	189	1	1	1	1	1	1	1	2	1	1	
Total	293	1,008	205	58	219	257	137	374	13	155	246	12	2	34	234	3,237	32	59	14	6	35	2	20	25	8	8	

Kind of quarry	Underground quarry—Continued						Shaft or slope						At outside works													
	Mine fires	Suffocation from natu- ral gases	Inrush of water	Stepping on nail	Handling materials (other than rock)	Total	Falling down shaft or slope	Objects falling down shaft or slope	Breaking of cables	Overwinding	Cage, skip, or bucket	Other causes	Total	Machinery	Hand tools	Stepping on nail	Electricity	Falls of persons	Falling objects (rocks, timbers, etc.)	Flying objects	Handling materials	Burns	Other causes	Total	Grand total	
	11	12	13	14	15	16	17	18	19	20	21	22		1	2	3	4	5	6	7	8	9	10	11		
Killed:						2																				
Cement rock.....															4	11	1									
Granite.....																		2	3	4				2	17	23
Limestone.....																										5
Limestone (chief product, lime)						1									3	3										13
Marble.....																										34
Sandstone.....																										12
Slate.....																										5
Trap rock.....																										2
Total.....						1	5							4	11	1										91
Injured:																										
Cement rock.....						23	112								70	36	6	10	87	45	40	71	45	50	480	728
Granite.....						1	1								22	22	4	3	12	3	64	37	1	35	222	763
Limestone.....						14	82								87	46	5	3	63	33	63	66	15	94	514	2,075
Limestone (chief product, lime)						7	44								39	50	9	10	43	27	53	94	75	89	520	1,118
Marble.....						9	21								22	3	1	13	19	9	62	1	30	165	250	
Sandstone.....						5	10								14	2			6	5	8	1	10	14	67	248
Slate.....						4	10								7	16	3		1	2	12	5	3	16	129	254
Trap rock.....							0								2	23	8		1	1	18	15	1	8	86	281
Total.....					34	56	291	1	1			4	6	117	304	171	29	28	235	148	297	397	151	336	2,183	5,717

Limestone (chief product, lime)												1	1
Sandstone												1	1
Total												2	8
Permanent partial: ²												30	42
Cement rock	1		2		9	4						1	4
Granite	1		1		1							1	25
Limestone	1	2	1		1							1	12
Limestone (chief product, lime)	1				1							1	30
Marble	1	1			1							1	6
Sandstone	1	1			2	1						1	9
Slate	1				1							1	4
Trap rock	1	1			1							1	2
Total	1	5	3	1	2	15	6					6	71
Temporary: ³													171
Cement rock	2		10	5	6	32	6						48
Granite	1	3	2	4	11	22	4						218
Limestone	10	18	8	11	22	40	5						737
Limestone (chief product, lime)	7	8	8	2	31	38	9						15
Marble	2	3	8	3	9	3	1						88
Sandstone	2	9	2	1	6	15	3						74
Slate	2	2	1	4	1	1	1						29
Trap rock	1	1	1	1	9	8	1						10
Total	24	56	40	32	10	49	165	29					162
All quarries:					2	6	1						14
Killed													128
Permanent total: ¹													5
Permanent partial: ²	1	5	3	1	2	15	6						71
Temporary: ³	24	26	56	40	32	10	49	165	29				330
Total, nonfatal	25	31	61	43	33	12	51	165	171	29			2,110
Total, fatal													84
Total													2,194

¹ Permanent total disability: Loss of both legs or arms, 1 leg and 1 arm, total loss of eyesight, paralysis, or other condition permanently incapacitating workman from doing any work of a gainful occupation.

² Permanent partial disability: Loss of 1 foot, leg, hand, or eye, 1 or more fingers, 1 or more toes, any dislocation where ligaments are severed, or any other injury known in surgery to be permanent partial disability.

³ Disability for more than remainder of day of accident.

TABLE 16.—*Cement-rock, marble, slate, and trap-rock quarries: Men employed and man-days, by States, during the year ended Dec. 31, 1936*

State	Number of quarries ¹	Men employed			Man-days of employment			Average days of employment per man		
		At quarry	At outside works	Total	At quarry	At outside works	Total	At quarry	At outside works	Total
Cement rock:										
Alabama.....	10	197	562	759	54,919	184,569	239,488	279	328	316
California.....	10	394	1,600	1,994	117,586	510,811	628,397	298	319	315
Illinois.....	6	256	1,029	1,285	69,571	311,883	381,454	272	303	297
Indiana.....	5	116	1,018	1,134	26,800	285,340	312,140	231	280	275
Iowa.....	5	165	967	1,132	38,022	248,968	286,990	230	257	254
Kansas.....	8	160	631	791	36,963	188,807	225,770	231	299	285
Michigan.....	10	136	1,542	1,678	36,828	424,668	461,496	271	275	275
Missouri.....	6	287	883	1,150	58,068	284,011	342,079	217	322	297
New York.....	14	281	1,415	1,696	50,604	329,723	380,327	180	233	224
Ohio.....	12	256	1,251	1,507	56,193	336,601	392,794	220	269	261
Pennsylvania.....	32	793	4,503	5,296	188,520	1,234,901	1,423,421	238	274	269
Tennessee.....	7	169	626	795	31,297	145,485	176,782	185	232	222
Texas.....	10	128	1,123	1,251	29,922	297,213	327,135	234	265	261
Virginia.....	3	81	366	447	17,121	97,391	114,512	211	266	256
Washington.....	6	117	430	547	27,301	133,979	161,280	233	312	295
West Virginia.....	3	236	327	563	68,210	91,476	159,686	289	280	284
Other States ²	31	650	3,329	3,979	165,413	887,443	1,052,856	254	267	265
Total.....	178	4,402	21,602	26,004	1,073,338	5,993,269	7,066,607	244	277	272
Marble:										
Missouri.....	6	94	112	206	23,099	36,039	59,138	246	322	287
Tennessee.....	11	309	570	879	62,271	164,353	226,624	202	288	258
Vermont.....	6	188	727	915	52,525	202,616	255,141	279	279	279
Other States ³	31	341	963	1,304	58,057	229,762	287,819	170	239	221
Total.....	54	932	2,372	3,304	195,952	632,770	828,722	210	267	251
Slate:										
New York.....	5	28	38	66	6,245	8,229	14,474	223	217	219
Pennsylvania.....	30	420	958	1,378	96,877	237,342	334,219	231	248	243
Vermont.....	23	213	291	504	54,533	69,808	124,341	256	240	247
Virginia.....	6	138	239	377	25,748	42,839	68,587	187	179	182
Other States ⁴	13	108	132	240	20,137	24,264	44,401	186	184	185
Total.....	77	907	1,658	2,565	203,540	382,482	586,022	224	231	228
Trap rock:										
California.....	19	147	127	274	31,190	24,691	55,881	212	194	204
Connecticut.....	16	197	89	286	43,736	20,449	64,185	222	230	224
Idaho.....	4	62	70	132	5,855	5,266	11,101	94	75	84
Maryland.....	7	169	64	233	36,719	15,114	51,833	217	236	222
Massachusetts.....	16	326	130	456	73,901	29,146	103,047	227	224	226
New Jersey.....	22	234	150	384	47,662	28,706	76,368	204	191	199
New York.....	4	87	62	149	24,179	16,955	41,134	278	273	276
Oregon.....	13	107	95	202	8,757	5,500	14,257	82	58	71
Pennsylvania.....	17	184	133	317	34,778	27,447	62,225	189	206	196
Virginia.....	4	75	23	98	14,104	4,377	18,481	188	190	189
Washington.....	20	228	93	321	96,408	11,829	48,237	160	127	150
Other States ⁵	8	162	97	259	20,894	12,846	33,740	129	132	130
Total.....	150	1,978	1,133	3,111	378,163	202,326	580,489	191	179	187

¹ Includes a small number of mills or other plants not operated in connection with quarries.² Includes Arkansas, Colorado, Florida, Georgia, Idaho, Kentucky, Louisiana, Maine, Maryland, Minnesota, Montana, Nebraska, New Jersey, Oklahoma, Oregon, South Dakota, Utah, Wisconsin, and Wyoming.³ Includes Alabama, Arkansas, California, Colorado, Georgia, Maryland, Massachusetts, New York, North Carolina, Virginia, Washington, and Wisconsin.⁴ Includes Arkansas, California, Georgia, Maine, Maryland, Massachusetts, and New Jersey.⁵ Includes Maine, Michigan, Minnesota, Rhode Island, Texas, and Wisconsin.

TABLE 17.—Cement-rock, marble, slate, and trap-rock quarries: Man-hours and number killed and injured, by States, during the year ended Dec. 31, 1936

State	Man-hours of employment			Number killed			Number injured			Widows	Orphans
	At quarry	At outside works	Total	At quarry	At outside works	Total	At quarry	At outside works	Total		
Cement rock:											
Alabama	402,750	1,390,891	1,793,641	---	1	1	1	8	9	1	1
California	835,057	3,753,121	4,588,178	1	---	1	116	127	243	0	0
Illinois	451,994	2,017,572	2,469,566	---	3	3	10	17	27	1	0
Indiana	176,161	2,108,430	2,284,591	---	---	---	5	5	10	---	---
Iowa	285,875	1,932,906	2,218,781	---	1	1	1	13	14	1	1
Kansas	279,581	1,397,536	1,677,117	---	2	2	2	10	12	2	5
Michigan	291,818	3,396,021	3,687,839	---	1	1	3	28	31	1	0
Missouri	392,511	1,847,678	2,240,189	---	---	---	1	9	10	---	---
New York	377,274	2,421,481	2,798,755	---	---	---	1	9	10	---	---
Ohio	416,090	2,608,855	3,024,945	2	---	2	5	1	6	2	6
Pennsylvania	1,436,290	8,902,376	10,338,666	2	5	7	14	51	65	6	14
Tennessee	246,103	1,132,659	1,378,762	---	1	1	5	19	24	0	0
Texas	255,321	2,166,337	2,421,658	---	1	1	4	20	24	1	0
Virginia	139,797	551,648	691,445	---	---	---	2	10	12	---	---
Washington	214,034	970,448	1,184,482	---	1	1	23	29	52	1	0
West Virginia	547,279	704,770	1,252,049	---	---	---	4	1	5	---	---
Other States ¹	1,247,479	6,510,310	7,757,789	1	1	2	51	123	174	1	1
Total	7,995,414	43,813,039	51,808,453	6	17	23	248	480	728	17	28
Marble:											
Missouri	184,798	288,309	473,107	---	---	---	13	12	25	---	---
Tennessee	555,768	1,358,184	1,913,952	---	1	1	17	30	47	1	5
Vermont	420,368	1,622,584	2,042,952	---	---	---	21	57	78	---	---
Other States ²	441,783	1,829,826	2,271,609	---	1	1	34	66	100	1	3
Total	1,602,717	5,098,903	6,701,620	---	2	2	85	165	250	2	8
Slate:											
New York	52,310	70,088	122,398	---	---	---	---	5	5	---	---
Pennsylvania	792,648	1,925,987	2,718,635	5	---	5	56	75	131	4	5
Vermont	468,678	599,797	1,068,475	---	---	---	43	27	70	---	---
Virginia	227,719	383,070	610,789	---	---	---	14	13	27	---	---
Other States ³	167,076	202,447	369,523	1	---	1	12	9	21	---	---
Total	1,708,431	3,181,389	4,889,820	6	---	6	125	129	254	4	5
Trap rock:											
California	247,347	196,564	443,911	---	---	---	23	28	51	---	---
Connecticut	367,956	174,948	542,904	1	1	2	21	7	28	1	1
Idaho	39,420	34,391	73,811	---	---	---	1	---	1	---	---
Maryland	313,173	126,842	440,015	---	---	---	7	---	7	---	---
Massachusetts	616,371	242,330	859,201	---	---	---	24	9	33	---	---
New Jersey	389,294	258,356	647,650	---	---	---	40	21	61	---	---
New York	164,176	105,748	269,924	1	---	1	7	---	7	1	4
Oregon	67,198	41,621	108,819	1	---	1	3	4	7	---	---
Pennsylvania	331,309	269,013	600,322	---	---	---	17	7	24	---	---
Virginia	150,545	36,099	186,644	1	---	1	7	---	7	1	0
Washington	256,449	90,457	346,906	3	---	3	30	10	40	1	3
Other States ⁴	187,420	113,066	300,486	---	---	---	15	---	15	---	---
Total	3,100,658	1,689,935	4,790,593	7	1	8	195	86	281	4	8

¹ Includes Arkansas, Colorado, Florida, Georgia, Idaho, Kentucky, Louisiana, Maine, Maryland, Minnesota, Montana, Nebraska, New Jersey, Oklahoma, Oregon, South Dakota, Utah, Wisconsin, and Wyoming.

² Includes Alabama, Arkansas, California, Colorado, Georgia, Maryland, Massachusetts, New York, North Carolina, Virginia, Washington, and Wisconsin.

³ Includes Arkansas, California, Georgia, Maine, Maryland, Massachusetts, and New Jersey.

⁴ Includes Maine, Michigan, Minnesota, Rhode Island, Texas, and Wisconsin.

TABLE 18.—Granite quarries: Men employed and man-days, by States, during the year ended Dec. 31, 1936

State	Number of quarries ¹	Men employed			Man-days of employment			Average days of employment per man		
		At quarry	At outside works	Total	At quarry	At outside works	Total	At quarry	At outside works	Total
California.....	30	883	379	1,262	234,408	98,516	332,924	265	260	264
Connecticut.....	8	54	58	112	10,744	12,967	23,711	199	224	212
Georgia.....	19	458	326	784	115,676	87,129	202,805	253	267	259
Maine.....	19	372	544	916	48,883	73,966	122,849	131	136	134
Maryland.....	6	71	4	75	17,415	976	18,391	245	244	245
Massachusetts.....	24	440	347	787	95,866	79,625	175,491	218	229	223
Minnesota.....	24	181	467	648	43,806	126,445	170,251	242	271	263
New Hampshire.....	9	88	144	232	10,891	21,445	32,336	124	149	139
New York.....	5	100	40	140	19,398	8,120	27,518	194	203	197
North Carolina.....	16	581	332	913	133,190	80,824	214,014	229	243	234
Oklahoma.....	6	48	52	100	10,120	13,270	23,390	211	255	234
Pennsylvania.....	14	130	63	193	28,062	14,910	42,972	216	237	223
Rhode Island.....	9	62	89	151	15,303	21,826	37,129	247	245	246
South Carolina.....	5	140	115	255	32,912	26,730	59,642	235	232	234
South Dakota.....	6	64	49	113	15,229	11,312	26,541	238	231	235
Texas.....	6	44	37	81	10,596	9,819	20,415	241	265	252
Vermont.....	11	690	58	748	164,082	10,790	174,872	238	186	234
Virginia.....	3	72	52	124	18,259	13,758	32,017	254	265	258
Wisconsin.....	19	141	207	348	26,840	38,911	65,751	190	188	199
Other States ²	34	160	101	261	17,197	24,497	41,694	107	243	160
Total.....	273	4,779	3,464	8,243	1,068,877	775,836	1,844,713	224	224	224

¹ Includes a small number of mills or other plants not operated in connection with quarries.² Includes Colorado, Delaware, Kansas, Missouri, Montana, New Jersey, Oregon, and Washington.

TABLE 19.—Granite quarries: Man-hours and number killed and injured, by States, during the year ended Dec. 31, 1936

State	Man-hours of employment			Number killed			Number injured			Wid-ows	Or-phans
	At quarry	At outside works	Total	At quarry	At outside works	Total	At quarry	At outside works	Total		
California.....	1,704,591	679,610	2,384,201	1	-----	1	135	10	145	1	0
Connecticut.....	90,180	105,560	195,740	-----	-----	-----	8	10	18	-----	-----
Georgia.....	1,038,893	766,573	1,805,466	-----	-----	-----	36	17	53	-----	-----
Maine.....	386,221	584,562	970,783	-----	-----	-----	16	30	46	-----	-----
Maryland.....	141,034	8,296	149,330	-----	-----	-----	25	1	26	-----	-----
Massachusetts.....	764,902	634,776	1,399,678	1	-----	1	31	18	49	1	0
Minnesota.....	346,352	991,108	1,337,460	-----	-----	-----	12	44	56	-----	-----
New Hampshire.....	87,553	172,228	259,781	-----	-----	-----	8	4	12	-----	-----
New York.....	156,924	66,116	223,040	-----	-----	-----	28	1	29	-----	-----
North Carolina.....	1,120,268	656,539	1,776,807	2	-----	2	57	13	70	1	0
Oklahoma.....	77,920	105,402	183,322	-----	-----	-----	10	4	14	-----	-----
Pennsylvania.....	228,916	120,532	349,448	-----	-----	-----	27	8	35	-----	-----
Rhode Island.....	123,922	175,808	299,730	-----	-----	-----	5	6	11	-----	-----
South Carolina.....	286,190	230,895	517,085	-----	-----	-----	37	3	40	-----	-----
South Dakota.....	121,829	90,492	212,321	-----	-----	-----	7	8	15	-----	-----
Texas.....	92,930	82,390	175,320	-----	-----	-----	9	12	21	-----	-----
Vermont.....	1,211,300	86,320	1,297,620	-----	-----	-----	61	-----	61	-----	-----
Virginia.....	174,336	140,642	314,978	-----	-----	-----	-----	1	1	-----	-----
Wisconsin.....	210,176	303,015	513,191	-----	-----	-----	18	24	42	-----	-----
Other States ¹	138,814	199,358	338,172	1	-----	1	11	8	19	-----	-----
Total.....	8,503,251	6,200,222	14,703,473	5	-----	5	541	222	763	3	0

¹ Includes Colorado, Delaware, Kansas, Missouri, Montana, New Jersey, Oregon, and Washington.

TABLE 20.—Limestone quarries: Men employed and man-days, by States, during the year ended Dec. 31, 1936

State	Number of quarries ¹	Men employed			Man-days of employment			Average days of employment per man		
		At quarry	At outside works	Total	At quarry	At outside works	Total	At quarry	At outside works	Total
Alabama.....	6	316	102	418	73,948	23,299	97,247	234	228	233
California.....	10	1,152	106	1,258	236,630	26,407	263,037	205	249	208
Colorado.....	8	113	18	131	17,574	3,065	20,639	156	170	158
Florida.....	23	472	228	700	90,064	49,599	139,663	191	218	200
Idaho.....	3	49	6	55	4,327	537	4,864	88	90	88
Illinois.....	58	1,779	790	2,569	375,905	163,725	539,630	211	207	210
Indiana.....	73	1,135	1,490	2,625	186,557	308,422	494,979	164	207	189
Iowa.....	35	325	101	426	48,862	13,164	62,026	150	130	146
Kansas.....	26	473	160	633	82,720	21,173	103,893	175	132	164
Kentucky.....	43	963	214	1,177	156,985	36,246	193,231	163	169	164
Maryland.....	12	88	33	121	11,863	4,082	15,945	135	124	132
Massachusetts.....	3	22	30	52	6,122	9,240	15,362	278	308	295
Michigan.....	15	788	565	1,353	184,778	139,813	324,591	234	247	240
Minnesota.....	18	255	127	382	36,435	30,838	67,273	143	243	176
Missouri.....	71	1,589	311	1,900	195,461	58,448	253,909	123	188	134
Nebraska.....	8	159	9	168	28,534	1,547	30,081	179	172	179
New York.....	59	1,261	606	1,867	266,292	121,525	387,817	211	201	208
Ohio.....	93	895	430	1,325	157,213	77,906	235,119	176	181	177
Oklahoma.....	11	205	61	266	35,419	10,044	45,463	173	165	171
Pennsylvania.....	132	2,059	1,218	3,277	440,626	285,910	726,536	214	235	222
Tennessee.....	15	321	109	430	55,048	23,116	78,164	171	212	182
Texas.....	13	291	141	432	57,931	30,911	88,842	199	219	206
Virginia.....	29	706	264	970	158,177	61,902	220,079	224	234	227
West Virginia.....	13	348	99	447	70,792	19,210	90,002	203	194	201
Wisconsin.....	40	510	136	646	67,945	19,996	87,941	133	147	136
Wyoming.....	5	79	20	99	13,130	4,001	17,131	166	200	173
Other States ²	39	390	171	561	68,367	34,764	103,131	175	203	184
Total.....	861	16,743	7,545	24,288	3,127,705	1,578,890	4,706,595	187	209	194

¹ Includes a small number of mills or other plants not operated in connection with quarries.

² Includes Arizona, Arkansas, Connecticut, Georgia, Louisiana, Maine, Montana, Nevada, New Mexico, North Carolina, Oregon, South Carolina, South Dakota, Utah, Vermont, and Washington.

TABLE 21.—Limestone quarries: Man-hours and number killed and injured, by States, during the year ended Dec. 31, 1936

State	Man-hours of employment			Number killed			Number injured			Wid-ows	Or-phans
	At quarry	At outside works	Total	At quar-ry	At out-side works	Total	At quar-ry	At out-side works	Total		
Alabama.....	659,532	202,744	862,276	-----	-----	-----	12	4	16	-----	-----
California.....	1,817,091	212,101	2,029,192	2	-----	2	108	4	112	1	1
Colorado.....	140,585	24,522	165,107	-----	-----	-----	14	-----	14	-----	-----
Florida.....	825,369	455,090	1,280,459	4	-----	4	24	3	27	-----	-----
Idaho.....	34,612	4,294	38,906	-----	-----	-----	1	-----	1	-----	-----
Illinois.....	2,646,718	1,236,070	3,882,788	1	1	2	157	91	247	2	0
Indiana.....	1,562,990	2,512,499	4,075,489	-----	3	3	99	124	223	2	1
Iowa.....	421,433	117,464	538,897	-----	-----	-----	23	8	31	-----	-----
Kansas.....	673,661	171,246	844,907	2	1	3	28	15	43	1	0
Kentucky.....	1,364,627	318,164	1,682,791	2	-----	2	84	9	93	0	0
Maryland.....	103,538	35,960	139,498	-----	-----	-----	5	1	6	-----	-----
Massachusetts.....	48,548	71,828	120,376	-----	-----	-----	11	11	22	-----	-----
Michigan.....	1,488,128	1,129,644	2,617,772	1	1	2	33	18	51	2	10
Minnesota.....	315,211	248,633	563,844	-----	-----	-----	34	5	39	-----	-----
Missouri.....	1,485,385	457,753	1,943,138	2	3	5	206	21	227	3	2
Nebraska.....	234,322	15,020	249,342	-----	-----	-----	4	1	5	-----	-----
New York.....	2,102,494	986,004	3,088,498	2	1	3	99	25	124	2	1
Ohio.....	1,400,168	679,534	2,079,702	-----	1	1	56	27	83	1	0
Oklahoma.....	296,964	86,137	383,101	-----	-----	-----	43	7	50	-----	-----
Pennsylvania.....	3,641,508	2,370,021	6,011,529	4	2	6	180	50	230	0	0
Tennessee.....	440,356	185,137	625,493	-----	-----	-----	34	1	35	-----	-----
Texas.....	495,078	260,790	755,868	-----	-----	-----	53	22	75	-----	-----
Virginia.....	1,360,180	523,641	1,883,821	1	-----	1	119	37	156	1	0
West Virginia.....	589,901	166,745	756,646	-----	-----	-----	23	2	25	-----	-----
Wisconsin.....	545,785	165,403	711,188	-----	-----	-----	59	7	66	-----	-----
Wyoming.....	105,040	32,008	137,048	-----	-----	-----	6	3	9	-----	-----
Other States ¹	574,899	310,410	885,309	-----	-----	-----	57	18	75	-----	-----
Total.....	25,374,123	12,978,862	38,352,985	21	13	34	1,561	514	2,075	15	15

¹ Includes Arizona, Arkansas, Connecticut, Georgia, Louisiana, Maine, Montana, Nevada, New Mexico, North Carolina, Oregon, South Carolina, South Dakota, Utah, Vermont, and Washington.

TABLE 22.—Limestone (chief product, lime) quarries: Men employed and man-days, by States, during the year ended Dec. 31, 1936

State	Number of quarries ¹	Men employed			Man-days of employment			Average days of employment per man		
		At quarry	At outside works	Total	At quarry	At outside works	Total	At quarry	At outside works	Total
Alabama.....	8	191	209	400	62,439	67,765	130,204	327	324	326
Arizona.....	4	66	62	128	21,838	19,047	40,885	331	307	319
California.....	8	77	152	229	23,503	49,491	72,994	305	326	319
Illinois.....	7	82	123	205	23,514	34,042	57,556	287	277	281
Indiana.....	5	86	141	227	21,651	42,864	64,515	252	304	284
Maine.....	3	60	128	188	14,930	31,236	46,166	249	244	246
Maryland.....	6	60	49	109	14,090	10,194	24,284	235	208	223
Massachusetts.....	6	90	130	220	23,999	38,386	62,385	267	295	284
Missouri.....	10	338	481	819	95,441	159,279	254,720	282	331	311
New York.....	9	69	150	219	13,147	31,782	44,929	191	212	205
Ohio.....	20	669	1,203	1,872	190,166	355,560	545,726	284	296	292
Pennsylvania.....	49	663	1,223	1,886	178,763	309,695	488,458	270	253	259
Tennessee.....	10	190	303	493	53,239	89,368	142,607	280	295	289
Virginia.....	22	354	441	795	100,955	133,997	234,952	285	304	296
Washington.....	6	137	86	223	27,159	23,188	50,347	198	270	226
West Virginia.....	5	225	226	451	62,056	67,504	129,560	276	299	287
Wisconsin.....	9	76	65	141	19,594	18,941	38,535	258	291	273
Other States ²	35	344	436	780	91,446	112,239	203,685	266	257	261
Total.....	222	3,777	5,608	9,385	1,037,930	1,594,578	2,632,508	275	284	281

¹ Includes a small number of mills or other plants not operated in connection with quarries.² Includes Arkansas, Colorado, Connecticut, Florida, Georgia, Idaho, Kentucky, Michigan, Minnesota, Montana, Nevada, New Jersey, New Mexico, Oregon, Rhode Island, South Dakota, Texas, Utah, and Vermont.

TABLE 23.—Limestone (chief product, lime) quarries: Man-hours and number killed and injured, by States, during the year ended Dec. 31, 1936

State	Man-hours of employment			Number killed			Number injured			Widows	Orphans
	At quarry	At outside works	Total	At quarry	At outside works	Total	At quarry	At outside works	Total		
Alabama.....	444,384	465,440	909,824	1	-----	1	28	14	42	0	0
Arizona.....	167,704	145,722	313,426	-----	-----	-----	1	-----	1	-----	-----
California.....	172,020	372,908	544,928	-----	-----	-----	16	30	46	-----	-----
Illinois.....	188,152	272,320	460,472	-----	1	1	21	22	43	1	0
Indiana.....	142,881	307,487	450,368	-----	-----	-----	2	5	7	-----	-----
Maine.....	118,145	218,573	336,718	-----	-----	-----	4	8	12	-----	-----
Maryland.....	131,427	97,458	228,885	-----	-----	-----	3	4	7	0	0
Massachusetts.....	194,295	308,700	502,995	1	-----	1	22	22	44	-----	-----
Missouri.....	742,347	1,155,858	1,898,205	-----	-----	-----	47	44	91	-----	-----
New York.....	105,178	259,015	364,193	-----	-----	-----	3	16	19	-----	-----
Ohio.....	1,438,158	2,768,196	4,206,354	1	2	3	92	83	175	2	4
Pennsylvania.....	1,457,622	2,544,699	4,002,321	2	1	3	95	95	190	3	8
Tennessee.....	430,199	746,014	1,176,213	-----	1	1	30	18	48	1	2
Virginia.....	852,816	1,104,137	1,956,953	1	-----	1	107	45	152	0	0
Washington.....	216,053	185,473	401,526	1	-----	1	37	16	53	0	0
West Virginia.....	468,974	532,002	1,001,066	-----	-----	-----	9	5	14	-----	-----
Wisconsin.....	147,025	150,267	297,292	-----	-----	-----	11	6	17	-----	-----
Other States ¹	716,828	882,309	1,599,137	-----	-----	-----	70	87	157	-----	-----
Total.....	8,134,208	12,516,668	20,650,876	7	5	12	598	520	1,118	7	14

¹ Includes Arkansas, Colorado, Connecticut, Florida, Georgia, Idaho, Kentucky, Michigan, Minnesota, Montana, Nevada, New Jersey, New Mexico, Oregon, Rhode Island, South Dakota, Texas, Utah, and Vermont.

TABLE 24.—Sandstone quarries: Men employed and man-days, by States, during the year ended Dec. 31, 1936

State	Number of quarries ¹	Men employed			Man-days of employment			Average days of employment per man		
		At quarry	At outside works	Total	At quarry	At outside works	Total	At quarry	At outside works	Total
California.....	11	51	17	68	9,879	3,964	13,843	194	233	204
Colorado.....	7	124	4	128	29,130	9,964	39,094	235	241	235
New York.....	37	135	73	208	13,568	9,605	23,173	101	132	111
Ohio.....	12	212	351	563	50,148	84,337	134,485	237	240	239
Pennsylvania.....	52	750	206	956	147,836	50,250	198,086	197	244	207
South Dakota.....	4	172	48	220	18,553	5,647	24,200	108	118	110
Tennessee.....	3	28	25	53	6,320	5,521	11,841	226	221	223
West Virginia.....	12	221	119	340	44,061	27,859	71,920	199	234	212
Wisconsin.....	7	124	18	142	33,283	3,578	36,861	268	199	260
Other States ²	26	302	142	444	56,321	27,774	84,095	186	196	189
Total.....	171	2,119	1,003	3,122	409,099	219,499	628,598	193	219	201

¹ Includes a small number of mills or other plants not operated in connection with quarries.

² Includes Alabama, Arizona, Idaho, Illinois, Iowa, Kansas, Kentucky, Maryland, Massachusetts, Minnesota, Montana, New Jersey, New Mexico, Texas, Virginia, Washington, and Wyoming.

TABLE 25.—Sandstone quarries: Man-hours and number killed and injured, by States, during the year ended Dec. 31, 1936

State	Man-hours of employment			Number killed			Number injured			Widows	Orphans
	At quarry	At outside works	Total	At quarry	At outside works	Total	At quarry	At outside works	Total		
California.....	77,597	31,712	109,309	-----	-----	-----	2	3	5	-----	-----
Colorado.....	183,040	7,712	190,752	-----	-----	-----	3	-----	3	-----	-----
New York.....	116,005	89,111	205,116	-----	-----	-----	18	2	20	-----	-----
Ohio.....	402,076	673,322	1,075,398	-----	-----	-----	14	13	27	-----	-----
Pennsylvania.....	1,215,700	428,966	1,644,666	-----	-----	-----	83	15	98	-----	-----
South Dakota.....	155,765	47,255	203,020	1	-----	1	2	2	4	0	0
Tennessee.....	54,480	48,867	103,347	-----	-----	-----	8	4	12	-----	-----
West Virginia.....	354,219	237,327	591,546	-----	-----	-----	18	21	39	-----	-----
Wisconsin.....	291,405	28,358	319,763	-----	-----	-----	25	1	26	-----	-----
Other States ¹	487,275	236,436	723,711	-----	-----	-----	8	6	14	-----	-----
Total.....	3,337,562	1,829,066	5,166,628	1	-----	1	181	67	248	0	0

¹ Includes Alabama, Arizona, Idaho, Illinois, Iowa, Kansas, Kentucky, Maryland, Massachusetts, Minnesota, Montana, New Jersey, New Mexico, Texas, Virginia, Washington, and Wyoming.

DIMENSION-STONE AND NONDIMENSION-STONE QUARRIES

Methods employed in quarrying stone and in handling the stone immediately after it has been quarried are governed largely by the ultimate use to which the material is to be put. Stone for building or monumental purposes must be quarried and handled with greater care than stone that can be used without regard to its shape or form or that will later be crushed or powdered for use as flux or aggregates or in the manufacture of cement or lime. Thus the quarrying or preparation of stone may be divided, from the viewpoint of the safety engineer, into two main classes: (1) Building or dimension stone and (2) crushed or nondimension stone. The characteristic hazards of quarrying occur with different degrees of frequency in these two classes of quarrying operations. Stone that is used in substantially

the form and size that it was when loaded at the quarry face forms only a small part of the total quantity of stone produced and accounts for only a small number of employees in the quarrying industry. (See tables 26 and 27.) Thus accident rates for the two classes of quarries may be compared more clearly if this small group is omitted and the two classes of operations are divided only on the basis of whether the stone is or is not to be crushed.

Reports from operating companies for 1936 showed an accident-frequency rate of 46.06 per million man-hours of employment for dimension-stone plants and 38.21 for nondimension-stone plants. Only a few years ago, rates of this kind usually appeared in the reverse order, the rates for nondimension-stone plants being less favorable than those for dimension-stone plants. Since 1926 an intensive safety campaign has been in progress in the crushed-stone industry. This campaign includes an annual competition for awards for outstanding achievement in the prevention of accidents known as the National Crushed Stone Association Safety Competition; the contest is conducted by the United States Bureau of Mines in cooperation with the Association. It is highly probable that the safety contests have largely contributed to the improvement in the accident record of the crushed-stone industry during that period.

The accident rates and the number of men employed at these two classes of quarries are shown in tables 26 to 30.

TABLE 26.—*Dimension-stone and nondimension-stone quarries: Men employed and man-days, by kind of quarry, during the year ended Dec. 31, 1936*

Kind of quarry	Men employed			Man-days of employment			Average days of employment per man		
	At quarry	At outside works	Total	At quarry	At outside works	Total	At quarry	At outside works	Total
Dimension stone:									
Granite.....	2,659	2,213	4,872	564,514	471,064	1,035,578	212	213	213
Limestone.....	946	1,377	2,323	152,337	296,290	448,627	161	215	193
Marble.....	846	2,289	3,135	180,209	610,208	790,417	213	267	252
Sandstone.....	604	529	1,133	118,535	119,446	237,981	196	226	210
Slate.....	751	1,374	2,125	173,646	322,963	496,599	231	235	234
Trap rock.....	3		3	324		324	108		108
Total.....	5,809	7,782	13,591	1,189,565	1,819,961	3,009,526	205	234	221
Nondimension stone:									
Cement rock.....	4,402	21,602	26,004	1,073,338	5,993,269	7,066,607	244	277	272
Granite.....	1,551	596	2,147	364,613	145,780	510,393	235	245	238
Limestone.....	15,582	6,068	21,650	2,933,128	1,264,385	4,197,513	188	208	194
Limestone (chief product, lime).....	3,777	5,608	9,385	1,037,930	1,594,578	2,632,508	275	284	281
Marble.....	72	68	140	12,089	19,310	31,399	168	284	224
Sandstone.....	1,433	459	1,892	278,613	97,126	375,739	194	212	199
Slate.....	156	284	440	29,894	59,529	89,423	192	210	203
Trap rock.....	1,934	1,106	3,040	368,593	195,981	564,574	191	177	186
Total.....	28,907	35,791	64,698	6,098,198	9,369,958	15,468,156	211	262	239
All other and not stated:									
Granite.....	569	655	1,224	139,750	158,992	298,742	246	243	244
Limestone.....	215	100	315	42,240	18,215	60,455	196	182	192
Marble.....	14	15	29	3,654	3,252	6,906	261	217	238
Sandstone.....	82	15	97	11,951	2,927	14,878	146	195	153
Slate.....									
Trap rock.....	41	27	68	9,246	6,345	15,591	226	235	229
Total.....	921	812	1,733	206,841	189,731	396,572	225	234	229
Grand total.....	35,637	44,385	80,022	7,494,604	11,379,650	18,874,254	210	256	236

NONDIMENSION STONE														
Killed:														
Cement rock.....	2												17	23
Granite.....													3	4
Limestone.....	1												10	30
Limestone (chief product, lime).....													1	12
Sandstone.....													5	1
Slate.....													1	5
Trap rock.....													1	7
Total.....	3												6	33
Injured:														82
Cement rock.....	112	1											50	728
Granite.....													3	303
Limestone.....	75												27	1,839
Limestone (chief product, lime).....	44	1											386	1,118
Marble.....													5	1,118
Sandstone.....	15												3	10
Slate.....													10	13
Trap rock.....	6												46	185
Total.....	31	42	252	1	1								232	4,501
ALL OTHER														
Killed:														
Limestone.....	1												1	2
Trap rock.....														1
Total.....	1												1	3
Injured:														
Granite.....														51
Limestone.....	7												22	34
Marble.....	1												9	5
Sandstone.....													1	9
Trap rock.....													1	7
Total.....	8												33	106

Tennessee.....	9261	227,497	2,010,423	1	50	.50	20.35	1,718	307,553	3,180,468	2	107	.63	33,64	6	968	6,876	-----			
Texas.....	92	18,915	151,570	-----	19	-----	125.35	1,700	441,196	3,406,395	1	109	.29	32,00	2	624	4,892	200.32			
Utah.....	-----	-----	-----	-----	181	-----	-----	181	46,548	371,543	-----	21	-----	56.52	-----	-----	-----	-----			
Vermont.....	2,062	532,876	4,224,564	-----	100	-----	44.08	182	44,122	364,308	-----	20	-----	76.80	-----	-----	-----	-----			
Virginia.....	344	62,125	550,095	-----	24	-----	42.93	2,490	631,107	5,004,087	3	334	50	63.87	12	2,650	21,200	94.34			
Washington.....	78	17,312	138,871	-----	3	-----	21.65	1,178	263,550	2,003,820	6	154	2.89	76.85	12	3,375	27,000	74.07			
West Virginia.....	105	18,757	158,256	-----	9	-----	59.86	1,696	432,401	3,450,951	-----	95	-----	24.14	53	10,886	92,716	53.93			
Wisconsin.....	491	98,271	774,873	-----	58	-----	74.85	204	153,309	1,329,113	-----	22	-----	66.85	26	7,257	65,307	76.56			
Wyoming.....	-----	-----	-----	-----	-----	-----	-----	77	24,711	175,880	-----	22	-----	123.08	-----	-----	-----	-----			
Other States ¹	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	82	4,501	.68	37.53	1,733	396,572	2,913,072	-----			
Total.....	13,591	3,009,526	24,228,240	6	1,110	.25	45.81	64,698	15,468,156	119,923,136	82	4,501	.68	37.53	1,733	396,572	2,913,072	3	106	1.03	36.39

¹ Includes Delaware and Nevada.

Tennessee.....	332	67,673	603,772	25	41.41	680	139,584	1,116,658	69	61.79	5	918	6,476	-----	-----	
Texas.....	43	7,816	62,780	8	127.43	469	98,079	857,084	62	72.34	-----	-----	-----	-----	-----	
Utah.....	-----	-----	-----	-----	-----	52	18,263	160,899	9	60.06	-----	-----	-----	-----	-----	
Vermont.....	1,072	267,368	2,068,393	124	59.95	84	174,550	160,599	6	59.65	-----	-----	-----	-----	-----	
Virginia.....	118	21,768	195,882	12	61.26	1,321	314,309	2,698,243	237	1.11	6	1,650	13,200	2	151.52	
Washington.....	22	3,980	31,845	3	94.21	561	391,372	743,636	46	6.68	4	1,125	9,000	1	111.11	
West Virginia.....	79	13,848	110,944	8	72.11	951	231,271	1,834,090	93	24.87	-----	-----	-----	-----	-----	
Wisconsin.....	274	57,173	496,228	34	74.52	569	86,569	797,705	78	116.67	43	8,724	74,616	5	67.01	
Wyoming.....	-----	-----	-----	-----	-----	52	19,822	127,200	11	186.42	-----	-----	-----	-----	-----	
Other States ¹	-----	-----	-----	-----	-----	58	17,981	136,321	18	133.12	10	3,014	27,124	5	184.34	
Total.....	5,809	1,189,565	9,555,049	2	57.14	28,907	6,093,193	48,706,762	49	2,915	921	206,841	1,494,553	2	1.34	48.84

¹ Includes Delaware and Nevada.

**NONFATAL-INJURY RATES FROM MAIN CAUSES OF ACCIDENTS
INSIDE OPEN QUARRIES IN PRINCIPAL QUARRYING STATES**

Forty-six States were represented in the reports received by the Bureau of Mines from quarry-operating companies for 1936. Only North Dakota and Mississippi did not furnish reports, and these two States probably would have been represented if it had been possible to learn the name and address of every pit and hillside quarry from which stone is extracted.

Although quarry activity is so widely distributed throughout the country, 58 percent of the employees and 60 percent of the nonfatal injuries in the quarry pits in 1936 were accounted for by operations in only 10 States. The 10 leading States, in the order of the number of men working inside the pits, were Pennsylvania, California, Illinois, New York, Missouri, Ohio, Virginia, Indiana, Vermont, and Michigan. The nonfatal-injury rates for these 10 States are shown in table 31 for seven principal causes of accidents in open-quarrying operations in the United States. About 80 percent of all nonfatal injuries at open quarries throughout the country are due to these seven causes.

The leading cause of injuries at open-pit quarries was handling materials. Accidents from this cause resulted in an injury rate of 18.47 for the country as a whole; the highest rate for any of the 10 leading States was 49.31 for Missouri and the lowest was 3.86 for Michigan. Accidents from flying objects ranked second among the dangers to which quarry workers were exposed. The injury rate for this hazard was 6.85 per million man-hours worked inside the open-quarry pits, the highest rate being 24.65 for Missouri and the lowest 2.64 for Ohio. Ranking third as a cause of accidental injuries were falls or slides of rock or overburden with an injury rate of 5.37, a high of 17.00 for Virginia, and a low of 1.31 for New York. The next hazard in the order of frequency of accidental injuries was falls of persons. This class of accidents resulted in an injury rate of 4.71 for the United States as a whole, the highest rate among the 10 leading States being 7.97 for Indiana and the lowest 1.59 for Vermont. Machinery accidents resulted in an injury rate of 4.51 for the United States, 9.27 for California, and 2.21 for Michigan. A rate of 4.01 was reported for accidents caused by haulage equipment; the highest rate for this class of accidents was 5.69 for Missouri and the lowest rate 0.55 for Michigan. Hand-tool accidents resulted in a rate of 3.75 for the United States, a high of 7.52 for New York, and a low of 0.53 for Vermont.

Table 31 shows the accident rates for the 7 principal classes of non-fatal injuries in the 10 principal quarry States for 1936.

TABLE 31.—*Nonfatal-injury rates per million man-hours of employment inside open quarries, during the year ended Dec. 31, 1936, in principal quarrying States, by chief causes of accidents*

Cause	United States	Pennsylvania	California	Illinois	New York	Missouri	Ohio	Virginia	Indiana	Vermont	Michigan
Handling materials.....	18.47	19.30	15.29	16.82	12.75	49.31	13.48	19.42	12.75	19.60	3.86
Flying objects.....	6.85	4.36	3.94	5.08	3.27	24.65	2.64	14.91	5.31	16.43	2.76
Falls or slides of rock or overburden.....	5.37	6.48	6.72	5.39	1.31	1.42	7.33	17.00	4.78	3.18	1.65
Falls of persons.....	4.71	6.61	6.26	5.08	4.25	5.22	4.69	5.20	7.97	1.59	2.76
Machinery.....	4.51	2.91	9.27	2.54	6.21	6.16	4.98	2.78	5.31	2.65	2.21
Haulage.....	4.01	4.49	3.94	3.80	2.61	5.69	5.28	4.16	1.60	2.12	.55
Hand tools.....	3.75	2.51	2.32	6.98	7.52	1.42	3.52	3.82	2.13	.53	1.10
Total, chief causes.....	47.67	46.66	47.74	45.69	37.92	93.87	41.92	67.29	39.85	46.10	14.89
All other causes.....	11.63	9.52	14.14	12.06	13.08	14.22	6.16	18.38	16.47	14.84	5.51
Total, open quarry.....	59.30	56.18	61.88	57.75	51.00	108.09	48.08	85.67	56.32	60.94	20.40

COMPARATIVE SEVERITY OF INJURIES

The proportion of accidents of any given degree of severity varies from year to year. Figures for a single year would hardly represent a normal distribution of quarry accidents according to the seriousness of injury. A classification of all accidents reported for 1936 shows that, of every 1,000 accidents reported, 16 caused death, 1 resulted in permanent total disability, 29 caused permanent partial disability, and 954 caused temporary disability lasting more than the remainder of the day on which the accident occurred. A large number of accidents, not included in standard statistics compiled by the Bureau of Mines for the quarrying industry or for other industries by other organizations, cause disability to the employees for perhaps a few minutes or a few hours; these are usually recorded, if at all, only by the companies at whose plants the accidents occur, as it is virtually impossible to obtain complete records of them on a national scale. Accidents of this class probably amount to 25 to 40 percent of the total number of accidents in the quarrying industry. If this class of accidents is omitted and only so-called "lost-time" or "disabling" injuries are included, a typical distribution of quarry accidents, classified by severity, is indicated by figures covering the past 5 years, 1932-36. These figures show that, of each 1,000 accidents, 14 resulted in the death of the injured worker, 1 caused permanent total disability, 29 caused permanent partial disability, and 956 caused temporary disability. Thus the year 1936 was close to normal in its distribution of accidents according to severity of injury, although fatalities increased somewhat in relative importance and temporary injuries declined slightly.

The last column of table 32 shows accident rates per million man-hours of employment for each of these four classes of accidents.

RATIO OF INJURIES TO FATALITIES

If the quarrying and related industries are considered as a whole, 63 disabling nonfatal injuries occurred for each fatal accident reported during 1936. This ratio of injuries to fatalities may be computed from the number of accidents shown in table 11. Accidents outside the quarries had a higher mortality ratio than those that occurred at the quarries. This fact was indicated by the figures for the two classes of work, which showed 1 fatality to 67 injuries for the quarries and 1 fatality to 57 injuries for work outside the quarries. In this respect the accident situation in 1936 differed from that in 1935, when the ratio of fatalities to nonfatal injuries was 1 to 77 for accidents connected with quarrying and 1 to 90 for accidents outside the quarries. The most serious cause of fatal accidents at the quarry proper—falls or slides of rock or overburden—had a ratio of 1 death to every 22 injuries. The ratio of injuries to fatalities for each of the principal causes of accidents in the industry may be judged approximately or computed exactly from the figures given in table 11.

TABLE 32.—All quarries: Number of fatalities and injuries, and fatality and injury rates, per million man-hours of employment, classified by severity of injury, 1927-36

NUMBER OF QUARRY ACCIDENTS							
Severity of injury	Total, 1927-31	1932	1933	1934	1935	1936	Total, 1932-36
Fatal.....	546	32	59	60	51	91	293
Permanent total ¹	53	2	5	3	7	8	25
Permanent partial ²	1,443	108	106	114	122	171	621
Temporary ³	45,185	3,464	3,526	3,807	4,023	5,538	20,358
Total.....	47,227	3,606	3,696	3,984	4,203	5,808	21,297

RATES PER MILLION MAN-HOURS OF EMPLOYMENT ⁴							
Fatal.....	0.553	0.342	0.671	0.630	0.464	0.619	0.548
Permanent total ¹.....	.054	.021	.057	.031	.063	.054	.047
Permanent partial ²	1.462	1.153	1.206	1.197	1.109	1.163	1.163
Temporary ³	45.791	36.965	40.119	39.965	36.562	37.657	38.127
Total.....	47.860	38.481	42.053	41.823	38.198	39.493	39.835
Number of employees per year.....	83,316	56,866	61,927	64,331	73,005	80,022	67,230

¹ Permanent total disability: Loss of both legs or arms, 1 leg and 1 arm, total loss of eyesight, paralysis, or other condition permanently incapacitating workman from doing any work of a gainful occupation.

² Permanent partial disability: Loss of 1 foot, leg, hand, or eye, 1 or more fingers, 1 or more toes, any dislocation where ligaments are severed, or any other injury known in surgery to be permanent partial disability.

³ Disability for more than remainder of day of accident.

⁴ Accident rates for 1927-31 computed on basis of man-hours worked, the number of man-hours for 1927-30 being estimated by assuming that all companies operated the same number of hours per man per day as did those companies actually reporting length of day.

UNDERGROUND QUARRIES

Although quarrying is characteristically an industry in which the employees work above ground, the Bureau of Mines canvass for 1936 revealed that 93 plants might be classed as mines because all work involved in the extraction of the stone was performed underground. The number of plants in operation was 11 more than the number reported in 1935. Most of the underground quarries produced limestone or cement rock, but a few were reported as producing other kinds

of stone. The combined accident-frequency rate for the entire group was 58.34 per million man-hours of employment underground. Operations in 23 States were represented by the 93 underground quarries, and the number of men working underground was 2,686. Contrary to what might be expected, as accidents usually occur with relatively greater frequency underground than above ground in most mineral industries, the accident rate for the underground quarries was lower and therefore more favorable than the rate for open quarries. This fact would suggest that the underground quarries are operated or controlled by companies whose operating policies include sound accident-prevention methods, as no other reason appears to account for the more-favorable accident rate for underground quarrying whose inherent hazards normally are believed to exceed those of quarries above ground where work is done by natural, rather than artificial light.

Table 33 gives the record of employment and accidents for underground quarrying for the calendar year 1936.

TABLE 33.—*Accident data for underground quarries in the United in 1936*

[Data cover underground and shaft operations only]

UNDERGROUND QUARRIES, BY KINDS OF STONE

	Number of plants	Men employed	Man-days of employment	Man-hours of employment	Average days of employment per man	Average hours of employment per man	Accidents		
							Killed	Injured	Rate per million man-hours
Cement and limestone ¹	76	2,345	581,511	4,539,121	248	1,936	4	244	54.64
Marble.....	4	158	42,243	337,944	267	2,139	-----	21	62.14
Sandstone and granite.....	5	60	13,166	118,123	219	1,969	-----	16	135.45
Slate and trap rock.....	8	123	22,379	181,059	182	1,472	-----	16	93.89
Total.....	93	2,686	659,299	5,176,247	245	1,927	5	297	58.34

UNDERGROUND QUARRIES, BY STATES

California.....	7	261	82,835	602,936	317	2,310	1	133	222.25
Illinois.....	4	82	21,540	163,871	263	1,998	-----	6	36.61
Kansas.....	3	51	11,198	99,584	220	1,953	-----	9	90.38
Kentucky.....	3	120	21,671	186,710	181	1,556	-----	3	16.07
Missouri.....	18	433	98,796	727,853	228	1,681	2	39	56.33
Ohio.....	5	158	33,437	245,236	212	1,552	1	3	16.31
Pennsylvania.....	20	772	190,558	1,539,292	247	1,994	-----	47	30.53
Tennessee.....	7	158	39,642	324,173	251	2,052	-----	9	27.76
West Virginia.....	6	217	55,691	454,514	257	2,095	-----	7	15.40
Other States ²	20	434	103,931	832,078	239	1,917	1	41	50.48
Total.....	93	2,686	659,299	5,176,247	245	1,927	5	297	58.34

¹ Includes quarries that produced limestone used chiefly for making lime.

² Includes Alabama, Colorado, Georgia, Maine, Maryland, Massachusetts, Michigan, Nevada, New York, Oregon, Rhode Island, Vermont, Virginia, and Wyoming.

ACCIDENTS AT CEMENT MILLS

The accident rate for the cement industry, including the quarrying of the stone and its manufacture into cement, was shown in table 13 to have been 14.49 per million man-hours of employment in 1936. Contrasted with this, the rate for the mills only—that is, excluding extraction of the stone and hauling it to the mill—was only 11.35 per million man-hours of employment at the mills. Similar rates for

cement mills in different States are given in table 34; the figures range from a rate of 0.38 for Ohio to one of 33.84 for California.

Falls of persons were responsible for more injuries than any other class of hazards to which cement-mill workers were exposed in 1936. Other leading causes of accidents at the mills were handling materials, machinery, falling objects, burns, flying objects, and hand tools.

TABLE 34.—*Accident rates, men employed, etc., at cement mills (including crushers and miscellaneous work) during the year ended Dec. 31, 1936*

State	Men employed	Man-shifts of employment	Average days of employment per man	Man-hours of employment	Killed	Permanent total	Permanent partial	Temporary	Total non-fatal	Killed per million man-hours	Injured per million man-hours
Alabama.....	562	184, 569	328	1, 390, 891	1	-----	-----	8	8	0.72	5.75
California.....	1, 600	510, 811	319	3, 753, 121	-----	-----	1	126	127	-----	33.84
Illinois.....	1, 029	311, 883	303	2, 017, 572	3	-----	1	16	17	1.49	8.43
Indiana.....	1, 018	285, 340	280	2, 108, 430	-----	-----	-----	5	5	-----	2.37
Iowa.....	967	248, 968	257	1, 932, 906	1	-----	1	12	13	.52	6.73
Kansas.....	631	188, 807	299	1, 397, 536	2	-----	-----	9	10	1.43	7.16
Michigan.....	1, 542	424, 668	275	3, 396, 021	1	-----	1	27	28	.29	8.24
Missouri.....	883	284, 011	322	1, 847, 678	-----	-----	-----	9	9	-----	4.87
New York.....	1, 415	329, 723	233	2, 421, 481	-----	-----	2	7	9	-----	3.72
Ohio.....	1, 251	336, 601	269	2, 608, 855	-----	-----	-----	1	1	-----	.38
Pennsylvania.....	4, 503	1, 234, 901	274	8, 902, 376	5	-----	5	46	51	.56	5.73
Tennessee.....	626	145, 485	232	1, 132, 659	1	-----	1	18	19	.88	16.77
Texas.....	1, 123	297, 213	265	2, 166, 337	1	1	5	14	20	.46	9.23
Virginia.....	366	97, 391	266	551, 648	-----	-----	-----	9	10	-----	18.13
Washington.....	430	133, 979	312	970, 448	1	-----	3	26	29	1.03	29.88
West Virginia.....	327	91, 476	280	704, 770	-----	-----	-----	1	1	-----	1.42
Other States ¹	3, 329	887, 443	267	6, 510, 310	1	-----	8	115	123	.15	18.89
Total.....	21, 602	5, 993, 269	277	43, 813, 039	17	1	30	449	480	.39	10.96

Severity of injury	Haulage	Machinery	Hand tools	Stepping on nail	Electricity	Falls of persons	Falling objects (rocks, timbers, etc.)	Flying objects	Handling materials	Burns	Other causes	Total
Killed.....	1	4	-----	-----	2	3	4	-----	1	-----	2	17
Permanent total.....	-----	-----	-----	-----	-----	1	-----	-----	-----	-----	-----	1
Permanent partial.....	3	11	4	-----	-----	2	3	2	3	-----	2	30
Temporary.....	17	59	32	6	10	84	42	38	68	45	48	449
Total, nonfatal.....	20	70	36	6	10	87	45	40	71	45	50	480

¹ Includes Arkansas, Colorado, Florida, Georgia, Idaho, Kentucky, Louisiana, Maine, Maryland, Minnesota, Montana, Nebraska, New Jersey, Oklahoma, Oregon, South Dakota, Utah, Wisconsin, and Wyoming.

PLANTS OPERATED WITHOUT FATAL ACCIDENTS

How few quarrying companies have the misfortune to record the death of an employee by accident is shown by the reports which the Bureau of Mines received from operating companies for 1936. Although 1,986 plants were active during the year, 74 plants accounted for the 91 fatal accidents in the entire industry. The Bureau's canvass of the industry for 1935 covered 2,076 active plants, of which only 46 reported deaths of employees by accidents, the number of employees killed being 51. The 74 plants at which 91 men were killed in 1936 employed 9,389 men, which is only 12 percent of the total number of men working in the entire industry in 1936. In

other words, 88 percent of all men working in the quarrying and related industries during 1936 were employed at plants that did not have a fatal accident. This record compares favorably with that for bituminous-coal mines for 1935 (figure not available for 1936) of 63 percent of the employees accounted for by mines that operated without a fatal accident. The quarrying industry also ranks favorably in this respect when compared with mining other than coal mining, the record for which in 1935 (figure for 1936 not available) showed 76 percent of the men working at mines that did not have a fatal accident during the year.

The proportion of the quarry industry that was free from fatal accidents in 1936 is shown for the United States as a whole and for each State separately in tables 35, 36, and 37.

TABLE 35.—Comparative fatal and nonfatal accident data for the quarrying and related industries in the United States during the year ended Dec. 31, 1936

	Plants that had no fatal accidents	Plants that had fatal accidents	All plants
Number of plants.....	1,912	74	1,986
Number of employees.....	70,633	9,389	80,022
Proportion of total employees.....percent.....	88.3	11.7	100.0
Number of employees per plant.....	37	127	40
Man-days of employment.....	16,396,353	2,477,901	18,874,254
Average worked per man.....days.....	232	264	236
Man-hours of employment.....	128,460,974	18,603,474	147,064,448
Average work per man.....hours.....	1,819	1,981	1,838
Number of men killed.....	.....	91	91
Number of men injured.....	4,859	858	5,717
Death rate per million man-hours.....	.....	4.89	0.62
Injury rate per million man-hours.....	37.82	46.12	38.87

TABLE 36.—Quarries and related plants: Number of men employed in 1936

State	At plants that had fatalities	At plants that had no fatalities	Employees represented by plants that had no fatalities, percent	State	At plants that had fatalities	At plants that had no fatalities	Employees represented by plants that had no fatalities, percent
Vermont.....	.....	2,244	100.0	New Jersey.....	60	844	93.4
West Virginia.....	.....	1,801	100.0	Connecticut.....	32	444	93.3
Wisconsin.....	.....	1,436	100.0	Virginia.....	207	2,648	92.7
Minnesota.....	.....	1,379	100.0	Florida.....	75	847	91.9
Oklahoma.....	.....	792	100.0	Missouri.....	335	3,769	91.8
Colorado.....	.....	633	100.0	Texas.....	176	1,708	90.7
Nebraska.....	.....	422	100.0	Indiana.....	406	3,580	89.8
South Carolina.....	.....	309	100.0	Ohio.....	566	4,701	89.3
Idaho.....	.....	290	100.0	Alabama.....	190	1,580	89.3
Arkansas.....	.....	243	100.0	United States.....	9,389	70,633	88.3
New Hampshire.....	.....	232	100.0	Pennsylvania.....	1,681	11,622	87.4
Rhode Island.....	.....	226	100.0	Georgia.....	410	1,712	80.7
Montana.....	.....	204	100.0	Washington.....	246	1,022	80.6
Wyoming.....	.....	204	100.0	Iowa.....	309	1,264	80.4
Louisiana.....	.....	187	100.0	Kansas.....	311	1,218	79.7
Utah.....	.....	181	100.0	Michigan.....	645	2,475	79.3
Arizona.....	.....	136	100.0	South Dakota.....	100	370	78.7
Other States ¹.....	.....	103	100.0	Tennessee.....	566	2,084	78.6
New Mexico.....	.....	102	100.0	Maryland.....	206	715	77.6
Oregon.....	3	677	99.6	North Carolina.....	232	789	77.3
Kentucky.....	52	1,391	96.4	Illinois.....	965	3,123	76.4
New York.....	184	4,196	95.8	California.....	1,253	3,886	75.6
Massachusetts.....	98	1,556	94.1				
Maine.....	81	1,288	94.1				

¹ Includes Delaware and Nevada.

TABLE 37.—*Quarries and related plants: Number of man-hours of employment in 1936*

State	At plants that had fatalities	At plants that had no fatalities	Man-hours represented by plants that had no fatalities, percent	State	At plants that had fatalities	At plants that had no fatalities	Man-hours represented by plants that had no fatalities, percent
Vermont.....	-----	4, 588, 872	100. 0	Florida.....	113, 690	1, 570, 430	93. 2
West Virginia.....	-----	3, 601, 307	100. 0	Maine.....	119, 336	1, 616, 607	93. 1
Minnesota.....	-----	2, 638, 729	100. 0	New Jersey.....	143, 351	1, 607, 017	91. 8
Wisconsin.....	-----	2, 115, 230	100. 0	Connecticut.....	71, 015	770, 946	91. 6
Oklahoma.....	-----	1, 514, 945	100. 0	Virginia.....	517, 654	5, 156, 728	90. 9
Colorado.....	-----	1, 040, 049	100. 0	Georgia.....	406, 016	3, 738, 276	90. 2
Nebraska.....	-----	809, 035	100. 0	Alabama.....	399, 619	3, 568, 424	89. 9
South Carolina.....	-----	655, 725	100. 0	Indiana.....	769, 881	6, 040, 567	88. 7
Arkansas.....	-----	513, 396	100. 0	Ohio.....	1, 226, 993	9, 159, 406	88. 2
Rhode Island.....	-----	436, 974	100. 0				
Utah.....	-----	371, 543	100. 0	United States.....	18, 603, 474	128, 460, 974	87. 4
Montana.....	-----	343, 846	100. 0				
Louisiana.....	-----	336, 817	100. 0	Pennsylvania.....	3, 340, 455	22, 325, 132	87. 0
Wyoming.....	-----	329, 113	100. 0	Texas.....	496, 690	3, 056, 267	86. 1
Arizona.....	-----	326, 322	100. 0	Washington.....	333, 063	1, 836, 337	84. 6
Idaho.....	-----	268, 610	100. 0	Michigan.....	1, 246, 433	5, 204, 078	80. 7
New Hampshire.....	-----	259, 781	100. 0	Iowa.....	599, 611	2, 163, 267	78. 3
Other States ¹	-----	241, 196	100. 0	Maryland.....	373, 104	1, 275, 524	77. 4
New Mexico.....	-----	177, 056	100. 0	Tennessee.....	1, 204, 115	3, 993, 652	76. 8
Oregon.....	5, 165	548, 756	99. 1	South Dakota.....	140, 000	449, 104	76. 2
Kentucky.....	66, 435	2, 203, 432	97. 1	Kansas.....	697, 713	2, 026, 871	74. 4
New York.....	302, 729	6, 845, 424	95. 8	North Carolina.....	516, 849	1, 496, 002	74. 3
Missouri.....	318, 149	6, 272, 478	95. 2	Illinois.....	1, 877, 059	4, 964, 159	72. 6
Massachusetts.....	190, 000	2, 938, 817	93. 9	California.....	3, 128, 349	7, 056, 727	69. 3

¹ Includes Delaware and Nevada.

LONG-TIME TREND OF ACCIDENT RATES IN THE QUARRY INDUSTRY

Statistics of accidents in the quarrying and related industries in the United States first became available when the Bureau of Mines collected reports from the operating companies for the calendar year 1911. The present bulletin, covering 1936, is the twenty-sixth annual publication on the subject.

During the last 14 of the 26 years for which comparable figures are available, the trend of the yearly accident rates for the industry has shown a gratifying downward course. During the first 5 years for which annual reports were collected the rate for nonfatal injuries rose rapidly, probably owing more to increasing coverage of slight or minor injuries by the companies' reports than to an actual increase in the number of accidents. This probability is strengthened by the accident rates during the years immediately following 1915. It is believed that by 1916 the reports from the operators reflected the actual number of nonfatal injuries with reasonable accuracy. After 1917 the accident rates dropped to a favorable low point for the 3 years 1918 to 1920, inclusive, and returned in 1921 to a level more in alignment with those for 1916 and 1917. For 1921 the nonfatal-injury rate was 62.16 per million man-hours of employment, and only twice (in 1923 and 1924) since that year has the injury rate been higher than that for 1921. The lowest injury rate recorded since 1916 was 37.73 for 1935. The rate for 1936 increased to 38.87.

Although the reports from the operating companies for 1911 to 1915 are believed to have been deficient in that they probably did not

include all of the minor nonfatal injuries that actually were sustained, it is reasonable to believe that the reports were complete, or substantially so, as to fatal accidents during those and later years. Failure of an operating company to remember and report the death of an employee is possible but not probable, although minor bruises, cuts, or other slight nonfatal injuries might easily have been overlooked when the accident reports for the Bureau of Mines were prepared by the operating company at the close of the year. It is believed that this situation prevailed, as regards nonfatal injuries, from 1911 to 1915.

The accident rates for fatal accidents during the 26 years 1911 to 1936 reached a high point in 1914, when the death rate was 0.94 per million man-hours of employment. Subsequent high points were 0.82 in 1920, 0.68 in 1922, and 0.67 in 1933. The 1933 rate was influenced by the loss of seven lives in a single disaster at a quarry in North Carolina. Notwithstanding the irregular course of the yearly fatality rates since 1911, their general trend has been decidedly downward. This shows the effectiveness of the accident-prevention work that has been conducted by the quarrying and related industries for many years. The figures covering the 26-year period are shown in table 38. Figure 1 presents graphically accident-frequency rates in the quarrying industry of the United States for the same period.

TABLE 38.—*Employment and accident data for the quarrying and related industries in the United States, 1911-36*

Year	Men employed	Average days of employment per man	Man-days of employment	Average hours of employment per day per man	Man-hours ¹ of employment	Killed	Injured	Rate per million man-hours	
								Killed	Injured ²
1911.....	110,954	228	25,325,094	-----	237,043,000	188	5,390	0.79	22.74
1912.....	113,105	249	28,151,042	-----	263,494,000	213	6,552	.81	24.87
1913.....	106,278	246	26,142,237	-----	244,691,000	183	7,739	.75	31.63
1914.....	87,936	233	20,456,157	-----	191,470,000	180	7,836	.94	40.93
1915.....	100,740	246	24,734,224	-----	231,512,000	148	9,671	.64	41.77
1916.....	90,797	253	22,937,178	-----	214,692,000	173	13,427	.81	62.54
1917.....	82,290	261	21,457,357	-----	200,841,000	131	13,242	.65	65.93
1918.....	68,332	260	17,785,504	-----	166,472,000	125	8,719	.75	52.38
1919.....	75,505	253	19,138,308	-----	179,135,000	123	9,199	.69	51.35
1920.....	86,488	267	23,126,648	-----	216,465,000	178	11,217	.82	51.82
1921.....	77,185	233	17,987,547	-----	168,363,000	120	10,465	.71	62.16
1922.....	79,081	261	20,658,338	-----	193,362,000	132	11,839	.68	61.23
1923.....	92,455	276	25,545,859	-----	239,109,000	143	14,990	.60	62.69
1924.....	94,242	269	25,327,858	9.36	236,982,774	138	14,777	.58	62.35
1925.....	91,872	273	25,045,955	9.31	233,222,241	149	14,165	.64	60.74
1926.....	91,146	271	24,708,400	9.33	230,464,889	154	13,201	.67	57.28
1927.....	91,517	271	24,782,561	9.27	229,805,889	155	13,459	.59	58.57
1928.....	89,067	272	24,397,377	9.22	224,953,034	119	10,568	.53	46.98
1929.....	85,561	268	22,967,379	9.22	211,765,529	126	9,810	.59	46.32
1930.....	80,633	255	20,559,372	9.07	186,502,184	105	7,417	.56	39.77
1931.....	69,200	224	15,526,503	8.61	133,750,124	61	5,427	.45	40.58
1932.....	56,866	195	11,114,135	8.43	93,709,860	32	3,574	.34	38.14
1933.....	61,927	183	11,362,151	7.74	87,888,263	59	3,637	.67	41.38
1934.....	64,351	204	13,108,274	7.27	95,258,880	60	3,924	.63	41.19
1935.....	73,005	200	14,623,303	7.52	110,033,341	51	4,152	.46	37.73
1936.....	80,022	236	18,874,254	7.79	147,064,448	91	5,717	.62	38.87

¹ Man-hours for 1911-23 computed on assumption that weighted average length of workday was 9.36 hours as shown by reports from representative operating companies for 1924.

² Injury rates for years previous to 1916 are believed not to be representative owing to probable incompleteness of reports of slight or minor injuries.

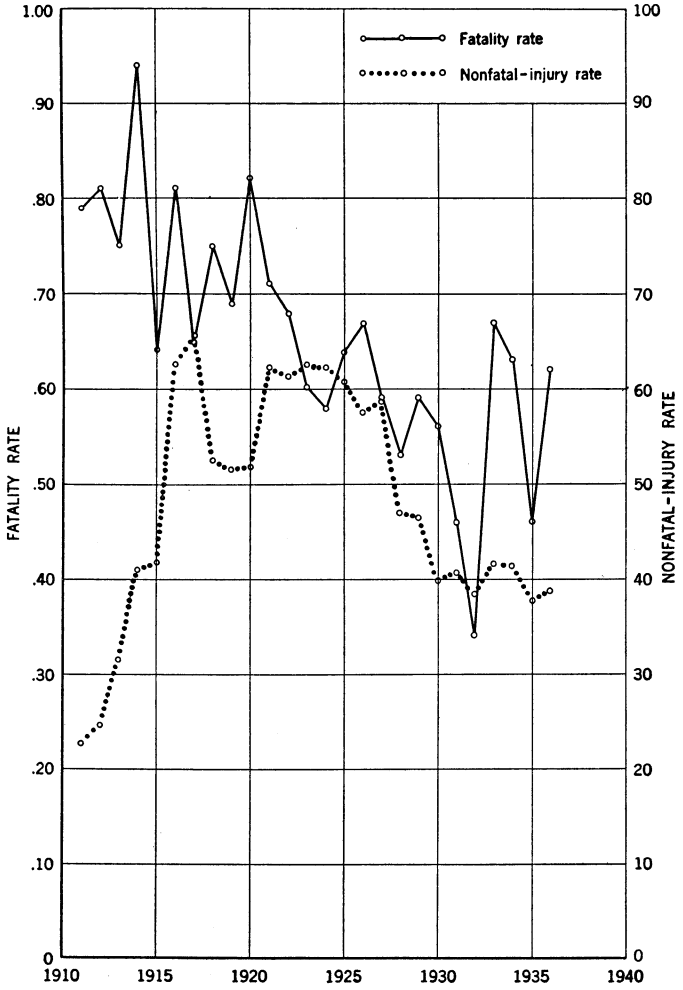


FIGURE 1.—Accident-frequency rates per million man-hours worked in the quarrying and related industries in the United States, 1911-36.

TABLE 39.—All quarries: Accident and labor data, by kinds of quarries, during the years ending Dec. 31, 1932 to 1936

Kind of quarry	Men employed			Man-days of employment			Average days of employment per man		
	At quarry	At out-side works	Total	At quarry	At out-side works	Total	At quarry	At out-side works	Total
Cement rock:									
1932.....	3, 198	13, 047	16, 245	596, 544	2, 960, 917	3, 557, 461	187	227	219
1933.....	3, 809	17, 096	20, 905	603, 631	3, 357, 311	3, 960, 942	158	196	189
1934.....	3, 906	19, 870	23, 776	772, 269	4, 784, 480	5, 556, 749	198	241	234
1935.....	3, 860	20, 556	24, 416	746, 151	4, 800, 032	5, 546, 183	193	234	227
1936.....	4, 402	21, 602	26, 004	1, 073, 338	5, 993, 269	7, 066, 607	244	277	272
Granite:									
1932.....	3, 499	4, 114	7, 613	639, 575	809, 331	1, 448, 906	183	197	190
1933.....	4, 177	3, 066	7, 243	684, 550	598, 285	1, 282, 835	164	195	177
1934.....	4, 480	3, 327	7, 807	843, 909	654, 194	1, 498, 103	188	197	192
1935.....	4, 040	2, 837	6, 877	818, 517	567, 512	1, 386, 029	203	200	202
1936.....	4, 779	3, 464	8, 243	1, 068, 877	775, 836	1, 844, 713	224	224	224
Limestone:									
1932.....	14, 154	8, 198	22, 352	2, 456, 645	1, 638, 188	4, 094, 833	174	200	183
1933.....	14, 623	8, 852	23, 475	2, 550, 767	1, 813, 796	4, 364, 563	174	205	186
1934.....	14, 620	9, 499	24, 119	2, 672, 669	1, 971, 773	4, 644, 442	183	208	193
1935.....	15, 887	6, 895	22, 782	2, 435, 888	1, 179, 430	3, 615, 318	153	171	159
1936.....	16, 743	7, 545	24, 288	3, 127, 705	1, 578, 890	4, 706, 595	187	209	194
Limestone (chief product, lime):									
1932.....	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
1933.....	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
1934.....	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
1935.....	3, 300	4, 891	8, 191	858, 259	1, 331, 175	2, 189, 434	260	272	267
1936.....	3, 777	5, 608	9, 385	1, 037, 930	1, 594, 578	2, 632, 508	275	284	281
Marble:									
1932.....	1, 281	3, 005	4, 286	279, 079	777, 624	1, 056, 703	218	259	247
1933.....	1, 252	2, 865	4, 117	249, 660	645, 634	895, 294	199	225	217
1934.....	661	1, 827	2, 488	131, 708	337, 061	468, 769	199	184	188
1935.....	827	1, 614	2, 441	152, 339	360, 142	512, 481	184	223	210
1936.....	932	2, 372	3, 304	195, 952	632, 770	828, 722	210	267	251
Sandstone:									
1932.....	1, 154	684	1, 838	148, 854	119, 986	268, 840	129	175	146
1933.....	1, 155	720	1, 875	137, 739	111, 297	249, 036	119	155	133
1934.....	1, 200	793	1, 993	167, 404	152, 889	320, 293	140	193	161
1935.....	1, 801	938	2, 739	279, 635	177, 582	457, 217	155	189	167
1936.....	2, 119	1, 003	3, 122	409, 099	219, 499	628, 598	193	219	201
Slate:									
1932.....	815	799	1, 614	114, 277	100, 215	214, 492	140	125	133
1933.....	833	776	1, 609	109, 218	98, 591	207, 809	131	127	129
1934.....	586	805	1, 391	85, 405	90, 711	176, 116	146	113	127
1935.....	805	1, 258	2, 063	148, 690	230, 695	379, 385	185	183	184
1936.....	907	1, 658	2, 565	203, 540	382, 482	586, 022	224	231	228
Trap rock:									
1932.....	2, 007	911	2, 918	328, 807	144, 093	472, 900	164	158	162
1933.....	1, 894	809	2, 703	276, 105	125, 567	401, 672	146	155	149
1934.....	1, 820	937	2, 757	279, 487	164, 315	443, 802	154	175	161
1935.....	2, 109	1, 387	3, 496	322, 536	214, 720	537, 256	153	155	154
1936.....	1, 978	1, 133	3, 111	378, 163	202, 326	580, 489	191	179	187
Total:									
1932.....	26, 108	30, 758	56, 866	4, 563, 781	6, 550, 354	11, 114, 135	175	213	195
1933.....	27, 743	34, 184	61, 927	4, 611, 670	6, 750, 481	11, 362, 151	166	197	183
1934.....	27, 273	37, 058	64, 331	4, 952, 851	8, 155, 423	13, 108, 274	182	220	204
1935.....	32, 629	40, 376	73, 005	5, 762, 015	8, 861, 288	14, 623, 303	177	219	200
1936.....	35, 637	44, 385	80, 022	7, 494, 604	11, 379, 650	18, 874, 254	210	256	236

¹ Included with limestone prior to 1935.

QUARRY ACCIDENTS IN THE UNITED STATES, 1936

TABLE 40.—All quarries: Accident and labor data, by kinds of quarries, during the years ending Dec. 31, 1932 to 1936

Kind of quarry	Man-hours of employment			Number killed			Number injured			Rates per million man-hours								
	At quarry	At outside works	Total	At quarry	At out-side works	Total	At quarry	At out-side works	Total	Killed		Injured						
										At quarry	At out-side works	Total	At quarry	At out-side works	Total			
Cement rock:																		
1932	5,084,436	25,184,478	30,268,914	2	3	5	112	220	332	0.39	0.12	0.17	23.03	8.74	10.97			
1933	4,508,128	24,491,855	28,999,983	3	4	7	82	250	332	1.06	.16	.48	18.19	10.21	11.45			
1934	5,436,358	32,301,236	37,737,594	6	12	18	132	327	459	1.10	.37	.24	24.28	10.12	12.16			
1935	5,305,243	33,937,775	39,243,018	3	9	12	90	272	362	.57	.39	.31	10.96	8.01	9.22			
1936	7,995,414	43,813,039	51,808,453	6	17	23	248	480	728	.75	.59	.44	31.02	10.96	14.05			
Granite:																		
1932	5,073,965	6,012,127	11,086,092	5	2	7	352	173	525	.99	.33	.63	60.37	28.78	47.36			
1933	5,245,322	4,573,964	9,819,286	12	1	13	331	144	475	2.29	.22	1.32	53.10	31.48	48.28			
1934	6,117,078	4,883,077	11,000,155	14	1	15	525	251	776	2.29	.20	1.30	50.83	51.40	70.84			
1935	6,151,107	4,404,309	10,555,416	6	4	10	431	139	570	.98	-----	.57	70.77	31.56	54.90			
1936	8,503,251	6,200,222	14,703,473	5	-----	5	541	222	763	.59	-----	.34	63.62	33.81	51.89			
Limestone:																		
1932	20,908,404	14,464,854	35,373,258	8	5	13	1,223	627	1,850	.38	.35	.37	58.49	43.95	52.30			
1933	20,080,004	14,612,106	34,692,110	22	7	29	1,430	679	2,109	1.10	.48	.84	71.21	42.47	60.70			
1934	20,695,528	14,963,114	35,658,642	16	1	17	1,488	537	2,025	.77	.07	.48	71.60	33.29	56.76			
1935	19,138,003	9,498,822	28,636,825	12	4	16	1,173	378	1,551	.63	-----	.89	61.29	38.79	54.16			
1936	25,374,123	12,978,862	38,352,985	21	13	34	1,561	514	2,075	.83	1.00	.89	61.52	39.00	54.10			
Limestone (chief product, lime):																		
1932	()	()	()	()	()	()	()	()	()	()	()	()	()	()	()	()	()	()
1933	()	()	()	()	()	()	()	()	()	()	()	()	()	()	()	()	()	()
1934	()	()	()	()	()	()	()	()	()	()	()	()	()	()	()	()	()	()
1935	6,464,768	10,095,798	16,560,566	8	-----	8	491	370	861	1.24	-----	.48	75.95	36.65	51.99			
1936	8,134,208	12,516,668	20,650,876	7	5	12	598	520	1,118	.86	.40	.58	73.52	41.94	54.14			
Marble:																		
1932	2,416,901	6,373,400	8,790,301	-----	1	1	127	270	397	-----	16	.11	52.55	42.96	45.16			
1933	2,089,060	5,261,888	7,350,954	1	2	3	78	164	242	-----	.48	.41	37.34	31.17	32.99			
1934	988,700	2,520,283	3,508,983	1	1	2	63	87	150	1.01	.40	.57	63.73	34.57	42.75			
1935	1,195,136	2,821,683	4,016,819	1	1	2	70	106	176	-----	.59	.57	58.57	37.57	43.82			
1936	1,602,717	5,098,903	6,701,620	2	2	4	85	165	250	-----	.39	.30	53.03	32.36	37.30			
Sandstone:																		
1932	1,281,632	1,026,829	2,308,461	1	-----	1	78	20	98	.78	-----	.43	60.85	19.48	42.45			
1933	1,140,060	899,915	2,039,975	-----	-----	-----	109	31	140	-----	-----	-----	63.71	34.45	68.63			
1934	1,290,775	1,145,253	2,436,028	2	-----	2	121	33	154	1.55	-----	.82	60.07	28.37	63.90			
1935	2,242,757	1,445,378	3,688,135	-----	-----	-----	202	41	243	-----	-----	-----	54.23	36.63	63.49			
1936	3,337,562	1,829,066	5,166,628	1	-----	1	181	67	248	.30	-----	.19	54.23	36.63	48.00			

Slate:	987, 817	852, 120	1, 839, 937	2	2	60	32	92	2.02	---	1.09	60.74	37.55	50.00
1932.....	909, 219	807, 571	1, 716, 790	2	2	61	44	105	2.20	---	1.17	67.09	54.48	61.16
1933.....	704, 542	723, 551	1, 428, 073	---	---	41	26	188	---	---	---	66.71	49.76	58.12
1934.....	1, 218, 427	1, 878, 912	3, 097, 339	1	1	107	63	168	.82	.53	.65	86.18	33.53	54.24
1935.....	1, 708, 431	3, 181, 389	4, 889, 820	6	6	125	129	254	3.51	---	1.23	73.17	40.55	51.94
1936.....	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Trap rock:	2, 809, 766	1, 232, 831	4, 042, 597	1	2	900	80	280	.36	1.62	.74	71.18	64.89	69.26
1932.....	2, 251, 008	1, 018, 157	3, 269, 165	3	3	174	60	234	.89	2.95	1.53	77.30	58.93	71.58
1933.....	3, 489, 405	1, 274, 309	3, 489, 405	6	6	206	71	277	2.71	---	1.72	93.00	55.72	79.38
1934.....	2, 215, 096	1, 683, 273	4, 253, 223	1	1	150	71	221	1.96	.59	1.42	58.78	42.18	52.18
1935.....	3, 100, 658	1, 689, 935	4, 790, 593	7	8	195	86	281	2.26	.59	1.67	62.89	50.89	58.66
1936.....	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total:	38, 563, 221	55, 146, 639	93, 709, 860	19	32	2, 152	1, 432	3, 574	.49	24	.34	55.80	25.79	38.14
1932.....	36, 222, 807	51, 665, 456	87, 888, 263	42	17	2, 295	1, 372	3, 637	1.16	.33	.67	62.53	26.55	41.38
1933.....	37, 448, 077	57, 810, 803	95, 258, 880	45	13	2, 585	1, 340	3, 924	1.20	.26	.63	68.95	23.21	41.19
1934.....	44, 267, 391	65, 765, 950	110, 033, 341	35	16	2, 212	1, 440	4, 152	.79	.24	.46	61.26	21.90	37.73
1935.....	59, 756, 364	87, 308, 084	147, 064, 448	53	38	3, 534	2, 183	5, 717	.89	.44	.62	59.14	25.00	38.87
1936.....	---	---	---	---	---	---	---	---	---	---	---	---	---	---

† Included with limestone prior to 1935.

NONCOMMERCIAL QUARRIES

The Bureau of Mines, in its canvass of accidents and employment at quarries in the United States for 1936, received reports from many plants that were operated by noncommercial agencies, such as States, counties, cities, and the Works Progress Administration. It is not believed that the reports received represented all operations of a noncommercial character, and it is impossible to state the extent of coverage represented by the reports. All reports received, however, were tabulated, and the results are shown in tables 41 to 44.

The reports on noncommercial quarries covered 272 plants operating in 30 States and having a total working force of 10,267 men and a total of 13.7 million man-hours of labor performed, an average of 174 days or 1,331 hours per man. The reports showed a weighted average workday of 7.6 hours. States having the largest number of employees were Kansas, Iowa, and New York. Most of the quarries reported that the stone produced was used chiefly for surfacing roads.

As stated, it is not known whether or not accidents to the employees were completely covered by the reports. When no accidents were shown on the report form it was assumed that none occurred. The number of accidents reported included 6 fatalities and 710 nonfatal lost-time injuries. These figures showed a fatality rate of 0.44 and an injury rate of 51.96 per million man-hours of work done by all employees during the year. Included among the nonfatal injuries were 11 cases of permanent partial disability and 699 of temporary injury. No accidents involved permanent total disability, according to the reports from the operating agencies.

All of the plants for which reports were received were open quarries. Two fatal accidents to the quarry men were caused by explosives, two by machinery, and one by flying objects. Nonfatal injuries resulted mainly from handling materials; this cause accounted for more than a third of the total number of injuries to employees inside the quarries. Other important causes of accidents were flying objects, falls of persons, hand tools, haulage equipment, and falls or slides of rock or overburden. A total of 90 accidents occurred outside the quarries, of which the chief causes were hand tools, machinery, and haulage. One fatal accident also was attributed to haulage equipment outside the quarries.

TABLE 41.—Noncommercial quarries: 1 Number of active quarries, men employed, man-days, man-hours, and average days active, by States, during the year ended Dec. 31, 1936

State	Num-ber of quar-ries	Men employed			Man-days of employment			Average days of employ-ment per man			Man-hours of employment		
		At quarry	At out-side works	Total	At quarry	At outside works	Total	At quarry	At out-side works	Total	At quarry	At outside works	Total
California.....	7	79	10	89	14,138	2,620	16,758	179	262	188	113,099	20,960	134,069
Illinois.....	19	455	152	607	76,142	22,476	98,618	167	148	162	599,074	176,468	775,542
Indiana.....	8	96	20	116	13,704	2,913	16,617	143	146	143	109,542	23,409	132,951
Iowa.....	34	1,234	354	1,588	231,616	65,430	297,046	188	185	187	1,413,917	411,626	1,825,543
Kansas.....	40	1,223	391	1,614	397,816	50,369	448,185	187	129	178	3,176,543	401,162	3,577,705
Kentucky.....	9	109	36	145	17,728	5,376	23,104	163	149	159	156,284	46,900	203,184
Michigan.....	7	188	17	205	25,345	2,004	27,349	135	118	133	221,548	16,032	237,580
Minnesota.....	5	147	14	161	29,910	1,748	31,658	203	184	197	193,500	76,200	269,700
Missouri.....	14	721	123	844	131,052	21,058	152,110	182	171	180	1,022,165	108,464	1,130,629
New York.....	29	881	120	1,001	165,442	15,843	181,285	188	132	181	1,272,234	128,231	1,400,465
North Carolina.....	3	104	16	120	21,426	3,356	24,782	206	210	207	171,406	26,852	198,258
Ohio.....	9	215	78	293	28,197	12,349	40,546	131	158	138	169,218	71,121	240,339
Oregon.....	15	122	56	178	16,095	9,328	25,423	132	167	143	114,105	67,777	181,882
Tennessee.....	13	435	140	575	90,916	29,133	120,049	209	208	209	804,697	255,514	1,060,211
Virginia.....	12	262	48	310	38,129	6,292	44,421	146	131	143	361,092	55,867	416,959
Washington.....	10	37	39	76	3,717	5,797	9,514	100	149	125	29,740	46,372	76,112
Wisconsin.....	13	427	139	566	71,566	21,561	93,127	165	155	165	575,127	172,096	747,223
Other States 2.....	25	651	178	829	107,112	19,641	126,753	168	110	153	841,629	154,704	996,333
Total.....	272	8,286	1,981	10,267	1,480,051	307,294	1,787,345	179	155	174	11,344,920	2,319,455	13,664,375

1 Operated by States, counties, municipalities, and the Works Progress Administration. Includes quarries producing limestone, granite, trap rock, and sandstone. The table does not purport to cover all noncommercial quarries but only such as furnished accident and employment data to the Bureau of Mines.

2 Includes Alabama, Arizona, Arkansas, Florida, Idaho, Maine, Montana, Nebraska, Oklahoma, Pennsylvania, Texas, Vermont, and West Virginia.

TABLE 42.—Noncommercial quarries: Accidents by States and severity of injury, during the year ended Dec. 31, 1936

State	Killed	Injured				Grand total
		Perma- nent total ¹	Perma- nent partial ²	Tempo- rary ³	Total non- fatal	
California.....				1	1	1
Illinois.....			2	24	26	26
Indiana.....						
Iowa.....	1		1	96	97	98
Kansas.....			4	167	171	171
Kentucky.....						
Michigan.....				4	4	4
Minnesota.....				12	12	12
Missouri.....	1		1	41	42	43
New York.....	2		2	82	84	86
North Carolina.....				4	4	4
Ohio.....				8	8	8
Oregon.....				16	16	16
Tennessee.....				40	40	40
Virginia.....	1					1
Washington.....				1	1	1
Wisconsin.....			1	37	38	38
Other States ⁴	1			166	166	167
Total.....	6		11	699	710	716

¹ Permanent total disability: Loss of both legs or arms, 1 leg and 1 arm, total loss of eyesight, paralysis, or other condition permanently incapacitating workman from doing any work of a gainful occupation.

² Permanent partial disability: Loss of 1 foot, leg, hand, or eye, 1 or more fingers, 1 or more toes, any dislocation where ligaments are severed, or any other injury known in surgery to be permanent partial disability.

³ Disability for more than remainder of day of accident.

⁴ Includes Alabama, Arizona, Arkansas, Florida, Idaho, Maine, Montana, Nebraska, Oklahoma, Pennsylvania, Texas, Vermont, and West Virginia.

TABLE 43.—Noncommercial quarries: Fatalities and injuries and rates per million man-hours, by States, during the year ended Dec. 31, 1936

State	Number killed					Number injured					Widows	Orphans	Rates per million man-hours					
	Open quarry	Underground quarry	Shaft or slope	Outside works	Total	Open quarry	Underground quarry	Shaft or slope	Outside works	Total			Killed			Injured		
													At quarry	At outside works	Total	At quarry	At outside works	Total
California.....						1				1						8.84		7.46
Illinois.....						26				26						43.40		33.52
Indiana.....																		
Iowa.....	1				1	91			6	97	1	0	0.71	0.55	64.36	14.58	53.13	
Kansas.....						142			29	171					44.70	72.29	47.80	
Kentucky.....																		
Michigan.....						4				4					18.05		16.84	
Minnesota.....						10		2		12					51.68	26.25	44.49	
Missouri.....	1			1	1	41		1	42	0	0	.97	.83	40.11	5.94	35.28		
New York.....	2			2	2	80		4	84	1	1	1.57	1.43	62.88	31.19	59.98		
North Carolina.....						4				4					23.34		20.18	
Ohio.....						6		2		8					35.46	28.12	33.29	
Oregon.....						14		2		16					122.69	29.51	87.97	
Tennessee.....						35		5		40					43.49	19.57	37.73	
Virginia.....			1	1							1	3	18.00	2.40				
Washington.....								1		1						21.56	13.14	
Wisconsin.....						36		2		38					62.59	11.63	50.85	
Other States ¹	1			1	1	131		35		166	1	2	1.19	1.00	155.65	226.24	166.61	
Total.....	5		1	6	6	621		89		710	4	6	.44	.43	.44	54.74	38.37	51.96

¹ Includes Alabama, Arizona, Arkansas, Florida, Idaho, Maine, Massachusetts, Montana, Nebraska, Oklahoma, Pennsylvania, Texas, Vermont, and West Virginia.

TABLE 44.—Noncommercial quarries: Accidents by causes and severity of injury during the year ended Dec. 31, 1936

Cause	Killed	Injured				Grand total
		Perma- nent total ¹	Perma- nent partial ²	Tempo- rary ³	Total non- fatal	
Open quarry:						
1. Falls or slides of rock or overburden.....				31	31	31
2. Handling materials.....			1	249	250	250
3. Hand tools.....			1	48	49	49
4. Explosives.....	2		1	2	3	5
5. Haulage.....			4	32	36	36
6. Falls of persons.....			1	62	63	63
7. Falling objects (other than 1 and 2).....				17	17	17
8. Flying objects.....	1		2	104	106	107
9. Electricity.....				1	1	1
10. Drilling and channeling (by machine or hand).....				22	22	22
11. Machinery.....	2			19	19	21
12. Stepping on nail.....				2	2	2
13. Boiler and air-tank explosions.....						
14. Burns.....				1	1	1
15. Other causes.....				21	21	21
Total.....	5		10	611	621	626
At outside works:						
1. Haulage.....	1			9	9	10
2. Machinery.....				16	16	16
3. Hand tools.....				17	17	17
4. Stepping on nail.....						
5. Electricity.....				1	1	1
6. Falls of persons.....			1	6	7	7
7. Falling objects (rocks, timbers, etc.).....				6	6	6
8. Flying objects.....				8	8	8
9. Handling materials.....				7	7	7
10. Burns.....						
11. Other causes.....				18	18	18
Total.....	1		1	88	89	90
Grand total.....	6		11	699	710	716

¹ Permanent total disability: Loss of both legs or arms, 1 leg and 1 arm, total loss of eyesight, paralysis, or other condition permanently incapacitating workman from doing any work of a gainful occupation.

² Permanent partial disability: Loss of 1 foot, leg, hand, or eye, 1 or more fingers, 1 or more toes, any dislocation where ligaments are severed, or any other injury known in surgery to be permanent partial disability.

³ Disability for more than remainder of day of accident.

FORM OF QUESTIONNAIRE

Figures 2 and 3 are representative of the questionnaire used in the 1936 canvass of the stone industry.

QUARRY ACCIDENTS IN THE UNITED STATES, 1936



UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF MINES
WASHINGTON

CONFIDENTIAL
FOR USE ONLY BY
THE BUREAU OF MINES

QUARRIES AND MILLS
ACCIDENTS AND EMPLOYMENT IN 1936

Name of quarry
Location of quarry:
State County
Nearest town
Location of mill:
State County
Nearest town

Please reply to the following questions and return the schedule as promptly as possible in the enclosed envelope which requires no postage. Replies are held strictly confidential, only State or district totals being published.
A SEPARATE REPORT SHOULD BE PREPARED FOR EACH QUARRY that was in operation for production or development purposes during the year ended December 31, 1936. Additional blanks will be forwarded upon request. Your cooperation will be appreciated.
If property was idle entire year, or abandoned or worked out during the year, please so state and answer remaining pertinent questions.
If property was sold or leased, or otherwise changed hands during the year, give name and address of present operator and date of change; fill out this form for the period during which property was under your control, and state period during which quarry or mill was operated by you.
The term "mill or other outside work" includes crusher, sawing and finishing plant, granules and flour plant, and miscellaneous work.

- State kind of rock quarried Principal use
- Employment:
(a) In the following table please indicate the average number of men (include lessees and owners or operators when working, but exclude office men) employed at the property, number of days actually operated, and length of shift. Total man-hours equal man-shifts times length of shift. If actual figures are not available, estimate man-hours from pay roll.

	AVERAGE NUMBER OF MEN WORKING	NUMBER OF DAYS ACTIVE	NUMBER OF SHIFTS PER 24 HOURS	LENGTH OF SHIFT (HOURS)	TOTAL MAN-SHIFTS WORKED DURING YEAR	TOTAL MAN-HOURS WORKED DURING YEAR
At quarry:						
Open quarry.....						
Underground quarry.....						
At mill or other outside works:						
Crusher.....						
Sawing and finishing plant.....						
Granules and flour plant.....						
Miscellaneous (specify).....						

- Number of days mine was active for production or development, during each month:
Jan.....; Mar.....; May.....; July.....; Sept.....; Nov.....
Feb.....; Apr.....; June.....; Aug.....; Oct.....; Dec.....

- Total quantity of material, both stone and waste, removed from your quarry or mine during 1936:
Stone (short tons, cubic feet, or (check which) Waste or overburden..... (short tons, cubic feet, or (check which))

- Indicate percentage of primary breaking by each of the following methods:
Coyote or gopher blasting% Piston drills%
Churn drills% Hammer drills%
Channelling machines% Wire saws%

Kind of power used for drilling (check which):
Steam; Electricity; Compressed air; Gasoline; Oil

- Kind of loading method (check which):
Hand; Power shovel; Other (please specify)
Kind of power used for shovel (check which):
Steam; Electricity; Compressed air; Gasoline; Oil

- Kind of quarry haulage (check which):
Hand; Power scraper; Trolley locomotive; Slackline cableway
Animal; Steam locomotive; Storage-battery locomotive; Hoisting and conveying cableway
Motor truck; Gasoline locomotive; Fireless-steam locomotive; Inclined plane
Aerial tram; Oil locomotive; Central electric; Hoist and skip

- Explosives used during the year (report in pounds or specify if other unit is used):

GRANULAR BLACK POWDER (Pounds)	PELLET BLACK POWDER (Pounds)	PERMISSIBLE EXPLOSIVES (Pounds)	DYNAMITE AND OTHER HIGH EXPLOSIVES (Pounds)	LIQUID OXYGEN (LOX) (Pounds)	LIQUID CARBON DIOXIDE (CARDOX) (Pounds)

- What was the date of the last lost-time injury at this quarry or plant prior to January 1, 1937? (A lost-time injury is one that disables an employee for more than the remainder of the day on which the accident occurred.)

- If any fatalities occurred at the quarry or plant during 1936, give the dates on which they occurred

- If any new quarries were operated in your vicinity during the past year, give names and addresses of the owners or operators:
.....
.....
.....

..... (Signature) (Official position)

FIGURE 2.—Questionnaire sent to plants in quarrying and related industries; face.

ACCIDENTS DURING THE YEAR ENDED DECEMBER 31, 1936

(IMPORTANT.—Include only accidents that caused disability for more than the remainder of the day on which the accident occurred)

OPEN QUARRY								
	Killed	Perma- nent total disa- bility	Perma- nent partial disa- bility	Temporary injuries (disability more than remainder of day of accident)	Killed	Perma- nent total disa- bility	Perma- nent partial disa- bility	Temporary injuries (disability more than remainder of day of accident)
Number killed or injured by—					Number killed or injured by—Contd.			
1. Falls or slides of rock or overburden.....					7. Falling objects (other than 1 and 2).....			
2. Handling materials:					8. Flying objects:			
(a) Handling rock at face.....					(c) From sledging.....			
(b) Handling other material.....					(d) Others.....			
3. Hand tools.....					9. Electricity:			
4. Explosives:					(a) Direct contact with trolley			
(c) Transportation.....					wire.....			
(d) Charging.....					(b) Bar or tool striking trolley			
(e) Drilling into old holes.....					wire.....			
(f) Striking in loose rock.....					(c) Contact with motor.....			
(g) Thawing.....					(d) Others.....			
(h) Caps, detonators, etc.....					10. Drilling and channeling (by ma- chine or hand).....			
(i) Unguarded shots.....					11. Machinery:			
(j) Returned too soon.....					(e) Hoisting cables and attach- ments.....			
(k) Premature shots.....					(f) Guys, cranes, derricks, and attachments.....			
(l) Delayed blast.....					(g) Pumps and hoisting engines.....			
(k) Miscellaneous.....					(h) Power shovels.....			
5. Haulage:					(i) Other machinery.....			
(a) Hand and animal.....					12. Stepping on nail.....			
(b) Mechanical.....					13. Boiler and air-tank explosions.....			
(c) Railway cars and locomotives.....					14. Burns.....			
6. Falls of persons:					15. Other causes.....			
(a) Falling into quarry from sur- face, benches, or face.....					Total killed or injured at open quarry.....			
(b) Falling from hoists, derricks, ladders, etc.....								
(c) Miscellaneous.....								

UNDERGROUND QUARRY (MINE)

Number killed or injured by—					Number killed or injured by—Contd.			
1. Fall of rock from roof or wall.....					14. Stepping on nail.....			
2. Rock while loading at working face or chute.....					15. Handling materials (other than rock).....			
3. Hand tools.....					16. Other causes.....			
4. Explosives.....					Total number killed or injured underground.....			
5. Haulage:					SHAFT OR SLOPE			
(a) Falling down chute, winch, raise, or slope.....					17. Falling down shaft or slope.....			
(b) Run of rock from chute or pocket.....					18. Objects falling down shaft or slope.....			
(c) Drilling.....					19. Breaking of cables.....			
(d) Electricity.....					20. Overwinding.....			
(e) Machinery (other than locomotives or drills).....					21. Cage, skip, or bucket.....			
(f) Mine fire.....					22. Other causes.....			
(g) Suffocation from natural gases.....					Total number killed or injured by shaft accidents.....			
(h) Inrush of water.....								

MILL OR OTHER OUTSIDE WORK

(See definition of mill on face of this blank)

Number killed or injured by—					Number killed or injured by—Contd.			
1. Haulage:					5. Electricity:			
(a) Hand and animal.....					(a) Direct contact with trolley			
(b) Mechanical.....					wire.....			
(c) Railway cars and locomotives.....					(b) Bar or tool striking trolley			
2. Machinery:					wire.....			
(a) Hoisting cables and attach- ments.....					(c) Contact with motor.....			
(b) Guys, cranes, derricks, and attachments.....					(d) Others.....			
(c) Pumps and hoisting engines.....					6. Falls of persons.....			
(d) Crushers.....					7. Falling objects (rocks, timbers, etc.).....			
(e) Other machinery.....					8. Flying objects:			
3. Hand tools.....					(a) From sledging.....			
4. Stepping on nail.....					(b) From crushing.....			
					(c) Others.....			
					9. Handling materials:			
					(a) Handling rock by hand.....			
					(b) Handling other materials.....			
					10. Burns.....			
					11. Other causes.....			
					Total number killed or injured at outside works.....			

Number of wives left widows..... Number of children under 16 years of age left fatherless.....

Do the above figures include all injuries that disabled an employee for more than the remainder of the day of accident?.....

1 PERMANENT TOTAL DISABILITY.—Loss of both legs or arms, 1 leg and 1 arm, total loss of eyesight, paralysis, or other condition permanently incapacitating workman from doing any work of a gainful occupation.

2 PERMANENT PARTIAL DISABILITY.—Loss of 1 foot, leg, hand, or eye, 1 or more fingers, 1 or more toes, any dislocation where ligaments are severed, or any other injury known in surgery to be permanent partial disability.

NOTE.—Injuries from flying particles should be charged to the tool or other agency that sets the particle in motion.

FIGURE 3.—Questionnaire sent to plants in quarrying and related industries; reverse.

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