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QUARRY ACCIDENTS

IN THE
UNITED STATES

DURING THE CALENDAR YEAR

1938

BY

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QUARRY ACCIDENTS IN THE UNITED STATES DURING THE CALENDAR YEAR 1938¹

By WILLIAM W. ADAMS² AND VIRGINIA E. WRENN³

INTRODUCTION

The quarrying and related industries of the United States improved their safety record in 1938 by reducing their accident-frequency rate to a lower and more favorable position than it has occupied at any time except 1935 since comparable accident statistics became available in 1916. The rates for 1935 and 1938 were identical. The number of men employed in 1938, although smaller than in 1936 and 1937, was larger than in any other year since 1930. Volume of employment, as measured by the number of man-hours worked in the industry as a whole, likewise was larger than in any year since 1930 except 1936 and 1937.

Reports from operating companies to the Bureau of Mines, United States Department of the Interior, showed that 77,497 men were employed in 1938, a decrease of 6,597 compared with 1937. This figure represents the average number of employees for the period during which the quarries and plants were active during the year, which in 1938 averaged 223 workdays per employee compared with 241 in 1937. A total of 17.3 million man-days or 133.8 million man-hours of work was shown for the industry as a whole, which indicated a weighted average of 7.75 hours per man-shift. Reports for 1937 showed a total of 158.3 million man-hours for the entire industry and an average workday of 7.81 hours. Accidents resulted in the death of 82 employees, 5 more than in 1937, and in 5,027 nonfatal injuries involving disability for more than the remainder of the day on which the injuries were received. The number of nonfatal injuries was 1,321 less than in 1937. As the number of deaths and injuries was reduced more, proportionately, than man-hours of employment, the accident-frequency rate per million man-hours of work declined, the rate for 1938 being 38.19 compared with 40.59 for 1937. In other words, accident occurrence to the average employee was 6 percent more favorable in 1938 than in 1937 on the basis of actual number of accidents and actual number of man-hours worked during the 2 years.

Separate figures covering quarries, as distinguished from work outside the quarries such as stone crushing, stone finishing, or the manufacture of cement or lime, showed an accident-frequency rate of 61.12 per million man-hours worked, a reduction of 3 percent from the rate for 1937. Reports covering work outside the quarries indicated a rate of 23.54, a reduction of 9 percent from 1937.

¹ Work on manuscript completed February 1940. Lucile S. Horton assisted in the preparation of the statistical tables herein presented.

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On the basis of kind of stone produced, all classes of operations reported reductions in employment in 1938 from 1937. All groups except marble quarries reported fewer accidents in 1938, as might be expected from the smaller volume of employment. However, not all groups had lower accident-frequency rates per million man-hours of employment or exposure to occupational hazards. Lower and more favorable rates were reported for cement, granite, lime, sandstone, and trap rock; higher rates were shown for limestone, marble, and slate.

The outstanding cause of fatal accidents among the quarry workers was falls or slides of rock or overburden; other important causes were explosives, machinery, haulage, and falls of persons. Nonfatal injuries to the same class of employees were due largely to handling materials, flying objects, and falls of persons. Fatal accidents to men employed at plants outside the quarries were caused mainly by machinery and falls of persons and nonfatal injuries chiefly by handling materials, machinery, and flying objects.

Five lives were lost in a single accident at a quarry at Asheville, N. C., on August 31, which was caused by an explosion of dynamite.

As the Bureau of Mines does not ask quarrying companies to furnish a separate report or full particulars regarding each accident, it is impracticable to state definitely the number of days of disability that resulted from accidents in the entire industry. However, the number may be estimated by using information obtained from individual reports of accidents at certain quarries that are enrolled in yearly safety contests, conducted by the Bureau, known as the National Safety Competition. These reports covered 681 temporary injuries during the past 3 years (1936-38) and showed an average of 31 days of disability per injury. The same reports covered 41 cases of permanent partial disability, averaging 990 days of disability per injury when each injury was weighted according to the standard scale of time charges based upon the type of injury and part of the body injured. These averages, together with a uniform charge of 6,000 days of disability for each death and permanent total disability, when applied to the 82 deaths, 5 permanent total disabilities, 153 permanent partial disabilities, and 4,869 temporary lost-time injuries in the quarrying and related industries of the United States in 1938 indicate a total of approximately 824,000 days of disability. As the total working time for all reporting companies was 133,766,000 man-hours, the total days of disability represented an average of 6.16 days per thousand man-hours of employment or exposure to risk. This accident-severity rate compares with rates of 5.36 for 1937 and 6.36 for 1936, computed in the same way and based upon the same average number of days of disability per accident as that used for 1938.

Pennsylvania was by far the leading quarry State in 1938, having about one-sixth of the total number of employees in all States combined. Other leading States, each having 3,000 or more employees engaged in quarrying or related work, were Ohio, New York, Illinois, Indiana, California, Missouri, and Michigan. When arranged according to their fatality rates per million man-hours of exposure, the leading States in which quarrying is an important industry (see table 1) were Kentucky, West Virginia, and Wisconsin. No fatal accidents occurred in these States in 1938 according to reports furnished

by the operating companies. When arranged according to their rates for nonfatal injuries, the States having the best records were Iowa, Michigan, and Kansas.

The 1938 canvass covered 2,136 quarries (including a small number of rock-dressing or other plants not operated in connection with quarries) in 47 States, while the 1937 canvass covered 2,082 plants in 46 States.

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, 1938

Relative standing	State	Number of men employed	Relative standing	State	Fatality rates	Relative standing	State	Injury rates
1	Pennsylvania	12,887	1	Kentucky	-----	1	Iowa	15.69
2	Ohio	5,384	2	West Virginia	-----	2	Michigan	17.90
3	New York	4,043	3	Wisconsin	-----	3	Kansas	19.06
4	Illinois	3,974	4	Virginia	0.17	4	Texas	21.27
5	Indiana	3,818	5	Georgia	.32	5	Illinois	21.29
6	California	3,560	6	Pennsylvania	.33	6	Ohio	25.46
7	Missouri	3,520	7	Iowa	.33	7	New York	27.06
8	Michigan	3,055	8	Michigan	.35	8	Pennsylvania	27.94
9	Virginia	2,995	9	Ohio	.41	9	West Virginia	32.55
10	Tennessee	2,916	10	Indiana	.49	10	Indiana	35.63
11	Alabama	2,369	11	Missouri	.54	11	Alabama	37.28
12	Vermont	2,173	12	Maine	.71	12	Maine	38.39
13	Texas	2,080	13	Texas	.72	13	Minnesota	38.81
14	Georgia	1,770	14	Vermont	.74	14	California	41.57
15	Iowa	1,675	15	Kansas	.81	15	Washington	44.36
16	West Virginia	1,514	16	California	.84	16	Missouri	44.74
17	Kentucky	1,428	17	Tennessee	.85	17	Massachusetts	46.22
18	Kansas	1,381	18	Massachusetts	.85	18	Vermont	47.07
19	Massachusetts	1,352	19	Minnesota	.86	19	Georgia	49.02
20	Minnesota	1,341	20	Illinois	.88	20	Virginia	50.19
21	Maine	1,239	21	New York	.89	21	Tennessee	61.47
22	Wisconsin	1,235	22	Alabama	.94	22	Kentucky	66.38
23	Washington	1,205	23	Washington	2.27	23	Wisconsin	85.77
	United States, total	77,497		United States, average	.61		United States, average	37.58

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 1938 compared with 1937

State	Number of accidents per million man-hours in 1938	Decrease compared with 1937, percent	State	Number of accidents per million man-hours in 1938	Increase compared with 1937, percent
Illinois	22.17	-54.4	Alabama	38.22	+0.1
Minnesota	39.67	-35.1	Virginia	50.36	+2
Massachusetts	47.07	-29.0	New York	27.95	+3.5
California	42.41	-28.1	Wisconsin	85.77	+4.9
Missouri	45.28	-25.5	Indiana	36.12	+23.5
Ohio	25.87	-17.5	Georgia	49.34	+32.7
Vermont	47.81	-15.9	Kentucky	66.38	+34.9
Iowa	16.02	-15.1	Michigan	18.25	+37.4
West Virginia	32.55	-13.9	Tennessee	62.32	+48.6
Washington	46.63	-12.8			
Kansas	19.87	-11.5	United States, average	38.19	-5.9
Pennsylvania	28.27	-8.5			
Maine	39.10	-4			
Texas	21.99	-1			

TABLE 3.—*Accident-frequency rates per million man-hours of employment in the quarrying industry in the United States, 1937 and 1938*

Kind of quarry	At quarries			At outside works			Total		
	1937	1938	Percent change in 1938	1937	1938	Percent change in 1938	1937	1938	Percent change in 1938
Cement rock.....	28.10	21.78	-22.5	9.55	8.19	-14.2	12.17	9.98	-18.0
Granite.....	61.89	51.95	-16.1	43.84	30.84	-29.7	54.04	42.93	-20.6
Limestone.....	64.01	67.18	+5.0	35.93	40.71	+13.3	53.92	57.12	+5.9
Limestone (chief product lime).....	73.44	74.23	+1.1	42.34	38.96	-8.0	54.65	52.51	-3.9
Marble.....	54.72	77.58	+41.8	49.07	46.87	-4.5	50.92	58.39	+14.7
Sandstone.....	80.75	70.77	-12.4	64.38	33.45	-48.0	75.31	58.15	-22.8
Slate.....	70.83	63.88	-9.8	47.69	52.50	+10.1	56.93	57.04	+2
Trap rock.....	94.69	72.91	-23.0	40.39	42.37	+4.9	75.76	62.85	-17.0
Total.....	62.84	61.12	-2.7	25.77	23.54	-8.7	40.59	38.19	-5.9

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 upon returns representing 2,136 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 laws, classes of accidents covered by State reports, 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 1934-38 are given in table 34, page 60.

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.

TABLE 4.—All quarries: Number of active quarries, men employed, and man-days, during the year ended Dec. 31, 1938

State	Number of active quarries ¹	Men employed						Man-days of employment											
		At quarry			At outside works			At quarry			At outside works								
		Open quarry	Under-ground quarry	Total	Crusher	Lime-kiln	Cement mill	Gran-ules and flour plant	Rock-dress-ing plant	Mis-cel-laneous	Total	Open quarry	Under-ground quarry	Crusher	Lime-kiln	Cement mill	Gran-ules and flour plant	Rock-dress-ing plant	Mis-cel-laneous	Total
Alabama	33	822	85	2,369	130	128	792	333	79	2,369	130	14,485	26,848	37,510	199,401	80,852	18,346	566,562	
Arizona	10	104	8	32	8	32	243	2	32	243	8	1,020	6,619	22,630	21,170	720	730	48,440	
Arkansas	9	325	197	62	20	62	18	8	2	3,608	311,823	53,132	87,110	31,788	408,363	1,321	6,203	76,649	
California	107	1,325	23	96	26	96	1,219	9	16	3,608	60,190	3,093	4,262	2,690	58,337	1,380	16,996	71,078	
Colorado	37	297	23	66	25	66	107	5	20	471	68,498	15,626	15,626	1,528	4,439	1,380	18,468	3,604	
Connecticut	29	294	454	23	240	23	174	1	28	920	81,603	688	47,671	3,500	49,272	770	10	4,439	
Florida	25	683	8	198	14	155	10	658	44	1,770	159,302	688	40,622	3,500	49,272	770	10	180,897	
Georgia	37	683	8	198	14	155	10	658	44	1,770	159,302	688	40,622	3,500	49,272	770	10	180,897	
Idaho	11	115	115	3	3	3	51	1	21	326	11,857	288	16,878	288	10,543	288	2	388,320	
Illinois	80	2,087	76	499	50	931	51	14	317	3,974	430,145	19,290	96,744	12,189	240,287	156	2,464	864,815	
Indiana	99	262	15	302	83	985	2	1,143	26	3,818	227,102	2,790	52,645	23,482	248,182	156	2,464	787,973	
Iowa	1	507	20	163	302	83	911	3	71	1,675	83,516	5,180	28,554	23,482	253,731	156	2,464	6,243	
Kansas	39	446	60	110	6	682	8	30	47	1,381	82,287	11,270	19,795	1	59,600	10,620	13,008	318,235	
Kentucky	41	818	89	276	6	428	200	15	22	1,428	145,923	13,565	49,818	16,175	27,285	1,978	4,759	277,324	
Maine	27	446	48	34	45	107	9	548	11	237	106,007	6,840	7,538	64,212	2,898	765	180,881		
Maryland	50	486	110	40	306	306	21	338	18	352	134,999	840	28,965	27,083	6,036	166	75,180	292,920	
Massachusetts	54	682	145	86	145	86	1,302	21	80	3,055	183,363	333	71,416	16,185	372,207	166	145,727	712,833	
Michigan	33	997	365	49	365	49	1,302	4	340	3,055	183,363	333	71,416	16,185	372,207	166	145,727	712,833	
Minnesota	97	469	67	35	838	838	199	561	6	1,341	81,854	77,903	53,508	10,713	44,628	908	1,252	260,562	
Missouri	57	340	455	288	327	838	327	142	126	3,628	229,438	77,903	53,508	81,433	258,141	1,218	37,906	764,125	
Montana	18	542	6	6	8	184	61	3	8	628	118,492	4,472	1,472	1,541	61,732	47	1,350	133,150	
Nebraska	7	75	22	22	22	184	184	182	45	326	17,207	804	4,272	1,541	61,732	37,208	14,373	97,584	
New Hampshire	12	161	12	12	12	355	182	182	60	959	18,350	32,082	804	3,507	63,450	37,208	17,154	56,362	
New Jersey	30	440	163	14	282	282	14	182	60	959	18,350	32,082	804	3,507	63,450	37,208	17,154	56,362	
New Mexico	40	78	14	14	14	8	8	8	2	102	7,133	7,133	1,151	13,670	277,846	4,830	8,700	8,700	
New York	116	1,746	36	708	65	1,219	25	19	225	4,043	326,983	10,100	138,754	13,670	277,846	4,830	4,184	881,473	
North Carolina	21	561	153	153	153	153	5	233	10	962	133,120	42,980	42,980	249,878	289,389	1,100	59,107	238,621	
Ohio	147	1,917	142	661	808	1,136	333	9	388	5,384	379,683	31,485	130,169	249,878	289,389	2,754	77,822	1,258,637	
Oklahoma	22	357	78	15	317	317	45	45	8,812	79,819	16,235	5,475	16,235	5,475	102,318	11,174	11,174	216,599	
Oregon	20	284	202	11	336	336	119	759	7	840	39,389	11,100	209,214	184,082	35,325	35,325	1,108	107,762	
Pennsylvania	357	4,003	803	1,110	518	4,315	3,315	119	12,887	751,771	130,111	3,012	209,214	184,082	1,093,552	35,325	153,387	2,794,903	
Rhode Island	8	278	167	44	167	167	3	72	24	182	12,280	3,012	588	861	16,377	16,377	16,377	4,416	39,244
South Carolina	9	278	167	44	167	167	3	72	24	182	12,280	3,012	588	861	16,377	16,377	16,377	4,416	39,244
South Dakota	17	242	44	44	44	62	62	65	42	458	70,652	4,816	7,176	940	12,028	15,382	15,382	10,581	87,923

Tennessee.....	58	1,222	128	185	271	548	4	470	88	2,916	289,816	32,512	41,269	75,471	128,741	1,212	128,225	16,047	713,293
Texas.....	41	466	---	188	76	1,053	---	93	204	2,080	107,254	---	36,873	21,011	288,867	---	24,186	49,846	528,037
Utah.....	10	84	---	17	13	99	---	---	28	2,241	15,272	---	3,188	3,240	20,315	---	5,782	47,797	---
Vermont.....	52	982	127	66	19	---	20	938	21	2,173	214,560	31,610	15,043	6,693	---	4,600	229,919	6,024	508,449
Virginia.....	83	499	15	433	279	275	11	169	314	2,995	337,210	3,379	107,281	83,154	79,751	1,958	23,314	73,949	709,996
Washington.....	49	630	---	67	84	397	3	19	5	1,205	101,350	---	11,250	20,441	92,884	348	4,593	207	231,073
West Virginia.....	31	506	209	181	148	236	4	21	209	1,514	91,248	50,611	33,745	31,202	50,997	1,200	3,014	48,536	310,553
Wisconsin.....	77	722	---	116	50	86	6	220	35	1,235	137,468	---	15,635	15,878	24,845	1,338	38,789	4,370	238,323
Wyoming.....	7	69	---	24	---	115	---	---	---	246	10,509	8,121	4,686	---	38,410	---	---	---	61,726
Other States ²	6	83	14	42	11	129	---	---	7	286	18,546	4,975	9,441	3,880	43,560	---	1,432	---	81,784
Total.....	2,136	30,740	2,004	8,208	3,509	19,927	280	7,597	4,632	77,497	6,109,611	514,300	1,607,565	991,528	5,259,681	67,238	1,642,727	1,063,178	17,285,828

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

² Includes Delaware, Louisiana, Mississippi, and Nevada.

TABLE 5.—All quarries: Number of man-hours and average days active, by States, during the year ended Dec. 31, 1938

State	At quarry		At outside works							Average days of employment per man		
	Open quarry	Under-ground quarry	Crusher	Limekiln	Cement mill	Granules and flour plant	Rock-dressing plant	Miscellaneous	Total	At quarry	At outside works	Total
Alabama	1,449,591	115,880	213,370	257,930	1,434,450	649,504	143,987	4,284,602	224	248	239	
Arizona	1,022,824	6,960	49,302	70,508	169,360	6,360	78,757	348,049	230	311	275	
Arkansas	180,439	416,353	604,127	227,677	3,113,073	10,568	543,059	7,143,934	206	340	316	
California	2,175,584	24,744	31,722	21,520	3,346,333	11,040	135,969	1,032,180	230	237	273	
Colorado	434,147	565,245	133,282	12,222	295,658	5,390	147,744	1,032,533	233	236	245	
Connecticut	714,533	4,810	415,290	28,000	394,344	5,390	68,708	1,537,991	180	213	177	
Florida	1,280,239	81,831	333,328	2,304	1,797,050	1,248	29,281	3,100,991	232	212	176	
Georgia	81,831	154,410	104,926	2,304	1,533,198	1,248	303,621	3,100,991	103	143	138	
Illinois	2,759,994	25,110	721,546	96,630	1,533,198	1,248	19,712	5,684,120	208	220	218	
Indiana	1,792,649	42,061	452,735	157,093	1,797,050	1,248	44,630	6,089,898	180	220	206	
Iowa	692,723	29,110	229,446	10,000	1,876,356	5,720	145,406	2,994,811	168	263	236	
Kansas	619,409	90,157	156,305	13,453	1,473,266	9,580	90,900	2,465,519	186	257	230	
Kentucky	1,311,932	122,466	471,292	61,640	1,473,266	16,801	40,414	2,465,519	176	226	194	
Maine	446,373	49,120	61,640	93,546	228,476	5,940	26,324	1,406,606	128	158	146	
Maryland	900,205	6,123	184,073	216,417	467,496	28,980	45,828	1,717,437	218	214	216	
Massachusetts	1,094,567	237,474	237,474	61,443	48,278	1,328	160,142	2,358,321	198	236	217	
Michigan	1,488,137	650,655	565,708	129,696	3,351,924	7,254	557,193	5,698,887	184	239	233	
Minnesota	650,655	830,102	400,289	630,102	1,765,273	9,740	198,697	5,587,330	175	265	217	
Missouri	1,947,947	692,446	11,776	12,330	81,984	300,376	96,073	1,065,330	210	170	212	
Montana	120,011	142,313	4,824	33,435	423,435	297,042	135,612	1,672,965	229	320	299	
Nebraska	757,093	10,928	275,736	28,458	511,060	2,970,442	135,612	444,179	114	196	159	
New Hampshire	66,865	80,800	1,146,146	109,810	2,242,988	42,720	398,074	1,707,959	217	224	221	
New Jersey	2,671,541	80,800	1,359,439	1,099,810	2,242,988	42,720	398,074	6,725,751	180	219	206	
New Mexico	3,002,248	240,561	1,062,457	1,829,138	2,226,466	22,032	733,628	9,739,346	237	263	248	
New York	3,002,248	240,561	1,062,457	1,829,138	2,226,466	22,032	733,628	9,739,346	200	200	234	
North Carolina	301,633	1,041,309	115,373	21,485	343,130	258,603	89,392	1,790,483	224	301	267	
Ohio	6,072,732	24,096	1,709,246	1,012,656	7,890,438	2,226,466	2,226,466	21,477,142	139	139	128	
Oklahoma	99,290	24,096	5,220	6,888	72,168	123,056	41,731	310,518	183	237	217	
Oregon	353,069	260,320	62,612	7,520	1,009,886	9,868	76,560	695,015	195	252	216	
Pennsylvania	451,846	260,320	845,332	610,536	1,009,886	9,868	76,560	695,015	173	256	254	
Rhode Island	859,401	859,401	308,607	175,074	2,229,376	2,229,376	1,015,486	5,904,878	239	240	245	
South Carolina	859,401	859,401	308,607	175,074	2,229,376	2,229,376	1,015,486	5,904,878	239	240	245	
South Dakota	859,401	859,401	308,607	175,074	2,229,376	2,229,376	1,015,486	5,904,878	239	240	245	
Tennessee	859,401	859,401	308,607	175,074	2,229,376	2,229,376	1,015,486	5,904,878	239	240	245	
Texas	859,401	859,401	308,607	175,074	2,229,376	2,229,376	1,015,486	5,904,878	239	240	245	

Utah.....	117,955	253,799	24,602	25,440	141,071	41,400	1,857,738	42,024	351,092	182	207	198
Vermont.....	1,656,045	133,432	133,432	63,048	523,323	17,008	209,306	52,656	4,058,118	222	247	234
Virginia.....	2,837,859	27,032	928,567	672,450	709,406	2,784	36,748	582,789	5,798,334	225	249	237
Washington.....	756,457	88,115	88,115	163,536	385,140	9,600	24,112	1,434	1,758,480	161	226	192
West Virginia.....	704,783	405,422	285,612	249,614	198,765	10,700	310,947	332,163	2,396,446	198	211	205
Wisconsin.....	1,111,506	64,961	128,467	125,909	307,280	-----	-----	25,717	1,912,011	190	197	193
Wyoming.....	84,058	38,473	37,496	30,638	387,285	-----	-----	12,887	493,795	174	310	251
Other States ¹	150,394	38,473	77,572	30,638	387,285	-----	-----	-----	697,249	242	308	286
Total.....	48,067,680	4,090,370	13,087,216	7,540,583	30,107,935	553,741	13,225,449	8,093,137	133,706,111	199	241	223

¹ Includes Delaware, Louisiana, Mississippi, and Nevada.

TABLE 6.—All quarries: Fatalities and injuries and rates per million man-hours, by States, during the year ended Dec. 31, 1938

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	2			2	4	102	1		56	159	2	2	1.28	0.74	0.94	65.79	20.75	37.28
Arizona						11			4	15						57.05	24.96	42.49
Arkansas	1				1	37			37	74			5.54		1.76	205.06	95.23	130.06
California	5			1	6	81	59		157	297	5	4	1.93	.22	.84	54.02	34.49	41.57
Colorado						20			20	34						30.51	35.44	33.23
Connecticut	1				1	30			24	54	1		1.77		1.10	53.07	70.12	59.50
Florida						47			39	86					.55	65.73	47.37	55.92
Georgia				1	1	93			59	152					.32	72.37	32.49	49.02
Idaho						19			8	27						232.13	37.76	91.93
Illinois	3			2	5	92	4		25	121	1	2	1.03	.72	.88	32.94	9.03	21.29
Indiana	2			1	3	94	6		117	217	3	4	1.10	.23	.49	55.01	27.39	35.63
Iowa	1				1	31	1		15	47	1	1	1.36		.33	43.55	6.64	15.69
Kansas	2				2	32	6		9	47	2	4	2.82		.81	53.55	5.13	19.06
Kentucky						114	11		38	163						87.14	37.21	66.38
Maine	1				1	22	6		22	54			2.02		.71	64.58	24.15	38.39
Maryland						60			14	74						66.20	17.26	43.09
Massachusetts	1			1	2	61			48	109	1	1	.91	.79	.85	55.73	37.98	46.22
Michigan	1				1	55			47	102	2	1	.68	.24	.35	37.46	11.11	17.90
Minnesota	1			1	2	44			46	90	1	1	1.54	.60	.86	67.62	27.58	38.81
Missouri	2	1			3	166	19		65	250	2	4	1.31		.54	81.09	19.66	44.74
Montana	5				5	46			6	52	3	9	5.27		4.69	48.53	51.15	48.82
Nebraska						2			1	3						16.67	1.81	4.46
New Hampshire	1				1	15			11	26	1		7.03		2.25	105.40	36.44	58.53
New Jersey						36			29	65						47.55	30.50	38.06
New Mexico						9			9	9						134.60		110.95
New York	5			1	6	102	1		79	182	3	10	1.82	.25	.89	37.42	19.88	27.06
North Carolina	5				5	46			19	65	4	3	4.56		2.55	41.93	21.98	33.14
Ohio	1			3	4	110	3		135	248	3	10	.31	.46	.41	34.85	20.78	25.46
Oklahoma				1	1	36			21	57	1	1	1.01		.62	56.74	21.26	35.14
Oregon						44			11	55						145.87	22.50	69.53
Pennsylvania	4			3	7	369	28		203	600	6	5	.56	.21	.33	55.80	14.13	27.94
Rhode Island						11	2		6	19						105.36	31.56	60.60
South Carolina	3				3	85			16	101	1	6	5.17		3.03	146.36	39.08	102.00
South Dakota						24			6	30						67.97	17.55	43.16
Tennessee	2	1		2	5	220	17		126	363	4	4	1.11	.63	.85	87.38	39.46	61.47
Texas	2			1	3	37			51	88	1	1	2.33	.30	.72	43.05	15.55	21.27
Utah						12			20	32						101.73	85.79	91.14
Vermont	3				3	96	8		87	191	2	1	1.57		.74	54.45	40.50	47.07
Virginia				1	1	183	3		105	291	1	1		.34	.17	64.92	35.79	50.19
Washington	4				4	60			18	78	4	7	5.29		2.27	79.32	17.96	44.36
West Virginia						27	9	5	37	78						36.93	28.77	32.55
Wisconsin						126			38	164						113.36	47.47	85.77
Wyoming						6	7		17	30						87.24	49.31	60.75
Other States ¹						18	3		7	28						111.19	13.77	40.16
Total	58	2		22	82	2,929	194	5	1,899	5,027	55	77	1.15	.27	.61	59.97	23.27	37.58

¹ Includes Delaware, Louisiana, Mississippi, and Nevada.

TABLE 7.—Hours of employment per man per year worked at various places in quarries, 1938

State	Average hours of employment per man per year								Total
	At quarry		At outside works					Miscellaneous	
	Open quarry	Under-ground quarry	Crusher	Lime-kiln	Cement mill	Gran-ules and flour plant	Rock-dressing plant		
Alabama	1,763	1,363	1,641	2,015	1,811		1,950	1,823	1,800
Arizona	1,854		870	2,485				2,305	2,006
Arkansas	1,940		2,465	2,555	2,920	795		2,555	2,341
California	1,642	2,113	1,669	2,372	2,554	1,174	1,771	1,688	2,007
Colorado	1,462	1,076	1,269	2,152	2,074		1,942	1,797	1,683
Connecticut	1,923		2,019	1,528		2,208	1,894	1,900	1,927
Florida	1,574		1,730	2,201	1,699		80	2,204	1,672
Georgia	1,874	602	1,683	2,000	2,543	539	1,515	1,321	1,752
Idaho	712		772	768	1,654			966	901
Illinois	1,322	2,032	1,446	1,933	1,647		1,408	1,257	1,430
Indiana	1,420	1,674	1,499	1,893	1,824	624	1,592	1,717	1,595
Iowa	1,366	2,103	1,408		2,063		1,910	2,049	1,788
Kansas	1,389	1,503	1,421	1,667	2,057		3,186	1,934	1,785
Kentucky	1,604	1,376	1,708	1,682	2,376		1,120	2,019	1,720
Maine	1,001	1,023	1,813	2,079	2,135		914	2,393	1,135
Maryland	1,852	1,531	1,673	1,967	1,528	3,220	1,485	2,552	1,758
Massachusetts	1,605		1,638	2,516		2,299	1,779	2,002	1,744
Michigan	1,473		1,550	2,647	2,286	664		1,639	1,865
Minnesota	1,387		695	2,449	1,764	1,816	2,081	1,653	1,728
Missouri	1,253	1,324	1,390	1,927	2,108	2,435	2,118	1,577	1,587
Montana	1,749		1,963	1,544	1,344		125	1,351	1,696
Nebraska	1,600		1,522		2,301			2,135	2,064
New Hampshire	884		402				1,632		1,251
New Jersey	1,721		1,692	2,033	1,812			2,260	1,781
New Mexico	857		781	336				320	795
New York	1,530	2,244	1,619	1,689	1,840	1,709	1,772	1,769	1,664
North Carolina	1,956		2,349			1,760	2,033	2,234	2,039
Ohio	1,566	1,694	1,607	2,264	1,960	2,448	1,928	1,891	1,809
Oklahoma	1,777		1,862	2,920	2,237		1,986		1,998
Oregon	1,062		571	1,953	1,021			1,266	941
Pennsylvania	1,517	1,297	1,540	1,955	1,829	2,173	1,620	1,795	1,667
Rhode Island	1,504	2,008	1,044	2,296			1,793	2,039	1,723
South Carolina	2,089		2,202					2,087	2,129
South Dakota	1,459		1,423	2,507	1,164		1,893	1,823	1,518
Tennessee	2,006	2,034	1,867	2,253	1,843	2,475	2,294	1,576	2,025
Texas	1,844		1,642	2,304	2,117		2,102	1,815	1,990
Utah	1,404		1,447	1,957	1,425			1,501	1,457
Vermont	1,686	1,998	2,022	3,318		2,070	1,981	2,507	1,868
Virginia	1,893	1,802	2,144	2,410	1,903	1,546	1,238	1,856	1,936
Washington	1,201		1,315	1,947	1,787	928	1,934	287	1,459
West Virginia	1,393	1,940	1,578	1,687	1,632	2,400	1,148	1,589	1,583
Wisconsin	1,539		1,107	2,518	2,311	1,783	1,413	735	1,548
Wyoming	1,218	1,710	1,562		2,672				2,007
Other States ¹	1,812	2,748	1,847	2,785	3,002			1,841	2,438
	1,564	1,571	1,594	2,149	1,963	1,978	1,741	1,747	1,726

¹ Includes Delaware, Louisiana, Mississippi, and Nevada.

TABLE 8.—All quarries: Fatalities, by causes and States, during the year ended Dec. 31, 1938—Continued

State	Underground quarry—Con.							Shaft or slope						At outside works											Grand total			
	Mine fires	Suffocation from natural gases	Inrush of water	Stepping on nail	Handling materials (other than rock)	Other causes	Total	Falling down shaft or slope	Objects falling down shaft or slope	Breaking of cables	Overwinding	Cage, skip, or bucket	Other causes	Total	Haulage	Machinery	Hand tools	Stepping on nail	Electricity	Falls of persons	Falling objects (rocks, timbers, etc.)	Flying objects	Handling materials	Burns		Other causes	Total	
Alabama																												
Arizona																												
Arkansas																												
California																												
Colorado																												
Connecticut																												
Florida																												
Georgia																												
Idaho																												
Illinois																												
Indiana																												
Iowa																												
Kansas																												
Kentucky																												
Maine																												
Maryland																												
Massachusetts																												
Michigan																												
Minnesota																												
Missouri																												
Montana																												
Nebraska																												
New Hampshire																												
New Jersey																												
	11	12	13	14	15	16		17	18	19	20	21	22		1	2	3	4	5	6	7	8	9	10	11		2	4

North Carolina.....	1	12	4	1	3	5	4	5	6	1	1	46	2	8	4	16	8	17	7
Ohio.....	4	20	5	1	9	13	20	20	7	5	9	110	1	1	1	1	1		
Oklahoma.....	9	4	3	1	0	4	2	5	1	1	1	36							
Oregon.....	5	32	1	1	1	1	1	36	1	14	28	34	6	1	5	1	4	2	1
Pennsylvania.....	27	130	20	8	21	46	17	1	1	23	2	369	4	1	5	1	4	2	1
Rhode Island.....	3	3	1									11							
South Carolina.....	5	34	2		1	6	1	12	1	1	2	85							2
South Dakota.....	13	43	26		8	24	7	30	16	12	1	274	9	3	2	1			
Tennessee.....	1	21	6	1	1	5	7	7	1	1	1	37							
Texas.....	1	2	1		1	5	2	10	5	0	2	106	1	2	1				
Utah.....	2	31	10	2	2	10	2	10	5	0	13	1							
Virginia.....	20	50	5	7	8	11	7	20	15	9	2	183	3	3					
Washington.....	4	0	25	5	2	7	1	6	1	3	3	60							
West Virginia.....	4	5	1	1	3	3	3	3	1	3	3	27	5					2	1
Wisconsin.....	10	44	7	1	6	13	5	13	6	6	4	126		1	2	1			
Wyoming.....	1			1	1	1		4		1	2	16		2	1				
Other States ¹		7	1		1	2				2		18							
Total.....	242	858	190	51	179	301	99	367	15	165	190	2,929	61	8	4	16	8	17	7

¹ Includes Delaware, Louisiana, Mississippi, and Nevada.

TABLE 10.—All quarries: Accidents by States and severity of injury, during the year ended Dec. 31, 1938

State	Killed	Injured				Grand total
		Perma- nent total ¹	Perma- nent partial ²	Tempo- rary ³	Total non- fatal	
Alabama.....	4		9	150	159	163
Arizona.....			1	14	15	15
Arkansas.....	1			74	74	75
California.....	6		9	288	297	303
Colorado.....			1	33	34	34
Connecticut.....	1		2	52	54	55
Florida.....			6	80	86	86
Georgia.....	1		2	150	152	153
Idaho.....			1	26	27	27
Illinois.....	5		3	118	121	126
Indiana.....	3		3	214	217	220
Iowa.....	1		2	45	47	48
Kansas.....	2			47	47	49
Kentucky.....			2	161	163	163
Maine.....	1		2	52	54	55
Maryland.....			3	71	74	74
Massachusetts.....	2		1	108	109	111
Michigan.....	2		4	98	102	104
Minnesota.....	2	1	2	87	90	92
Missouri.....	3		4	246	250	253
Montana.....	5		3	49	52	57
Nebraska.....			1	2	3	3
New Hampshire.....	1			26	26	27
New Jersey.....			4	61	65	65
New Mexico.....				9	9	9
New York.....	6	1	11	170	182	188
North Carolina.....	5		4	61	65	70
Ohio.....	4		11	237	248	252
Oklahoma.....	1	2	4	51	57	58
Oregon.....			4	51	55	55
Pennsylvania.....	7		13	587	600	607
Rhode Island.....			1	18	19	19
South Carolina.....	3		4	97	101	104
South Dakota.....			1	29	30	30
Tennessee.....	5		8	355	363	368
Texas.....	3		4	84	88	91
Utah.....				32	32	32
Vermont.....	3		6	185	191	194
Virginia.....	1	1	8	282	291	292
Washington.....	4		4	74	78	82
West Virginia.....	4		3	75	78	78
Wisconsin.....			1	163	164	164
Wyoming.....			1	29	30	30
Other States ⁴				28	28	28
Total.....	82	5	153	4,869	5,027	5,109

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, Louisiana, Mississippi, and Nevada.

TABLE 11.—All quarries: Accidents, by causes and severity of injury, during the year ended Dec. 31, 1938

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.....	18		10	232	242	260
2. Handling materials:						
(a) Handling rock at face	3		9	728	737	740
(b) Handling other materials			2	119	121	121
3. Hand tools.....			1	189	190	190
4. Explosives:						
(a) Transportation.....				1	1	1
(b) Charging.....	1			3	3	4
(c) Drilling into old holes.....	1		1	7	8	9
(d) Striking in loose rock.....	1			2	2	3
(e) Thawing.....						
(f) Caps, detonators, etc.....			1	3	4	4
(g) Unguarded shots.....				3	3	3
(h) Returned too soon.....			1	1	2	2
(i) Premature shots.....	6		1	3	4	10
(j) Delayed blast.....						
(k) Miscellaneous.....		1	1	22	24	24
5. Haulage:						
(a) Hand and animal.....	1		3	31	34	35
(b) Mechanical.....	1		1	76	77	78
(c) Railway cars and locomotives.....	4		2	66	68	72
6. Falls of persons:						
(a) Falling into quarry from surface benches or face.....	4		1	62	63	67
(b) Falling from hoists, derricks, ladders, etc.....	1		4	50	54	55
(c) Miscellaneous.....	1		2	182	184	185
7. Falling objects (other than 1 and 2).....	1		1	98	99	100
8. Flying objects:						
(a) From sledging.....			8	220	228	228
(b) Others.....			1	138	139	139
9. Electricity:						
(a) Direct contact with trolley wire.....						
(b) Bar or tool striking trolley wire.....	1			2	2	3
(c) Contact with motor.....				2	2	2
(d) Others.....	3			11	11	14
10. Drilling and channeling (by machine or hand).....			10	155	165	165
11. Machinery:						
(a) Hoisting cables and attachments.....	2		4	30	34	36
(b) Guys, cranes, derricks, and attachments.....			1	38	39	39
(c) Pumps and hoisting engines.....				3	3	3
(d) Power shovels.....	2		6	39	45	47
(e) Other machinery.....	3		5	64	69	72
12. Stepping on nail.....				16	16	16
13. Boiler and air-tank explosions.....				1	1	1
14. Burns.....	1	1		57	58	59
15. Other causes.....	3		1	196	197	200
Total, at open quarry.....	58	2	77	2,850	2,929	2,987
UNDERGROUND						
1. Fall of rock from roof or wall.....			1	31	32	32
2. Rock while loading at working face or chute.....			3	58	61	61
3. Hand tools.....			1	7	8	8
4. Explosives.....	1		2	2	4	5
5. Haulage.....	1		1	15	16	17
6. Falling down chute, winze, raise, or slope.....						
7. Run of rock from chute or pocket.....				8	8	8
8. Drilling.....			1	16	17	17
9. Electricity.....						

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, 1938—Continued

Cause	Killed	Injured				Grand total
		Perma- ment total	Perma- ment partial	Tempo- rary	Total non- fatal	
UNDERGROUND—continued						
10. Machinery (other than locomotives or drills).....				7	7	7
11. Mine fires.....						
12. Suffocation from natural gases.....						
13. Inrush of water.....						
14. Stepping on nail.....				6	6	6
15. Handling materials (other than rock).....				9	9	9
16. Other causes.....				26	26	26
Total, at underground quarry.....	2		9	185	194	196
SHAFT OR SLOPE						
17. Falling down shaft or slope.....						
18. Object falling down shaft or slope.....				1	1	1
19. Breaking of cables.....				2	2	2
20. Overwinding.....						
21. Cage, skip, or bucket.....						
22. Other causes.....				2	2	2
Total, in shaft or slope.....				5	5	5
OUTSIDE WORKS						
1. Haulage:						
(a) Hand and animal.....			1	41	42	42
(b) Mechanical.....	2		2	37	39	41
(c) Railway cars and locomotives.....			1	44	45	45
2. Machinery:						
(a) Hoisting cables and attachments.....			2	30	32	32
(b) Guys, cranes, derricks, and attachments.....	3		2	35	37	40
(c) Pumps and hoisting engines.....				4	4	4
(d) Crushers.....	1		3	42	45	46
(e) Other machinery.....	3	1	30	147	178	181
3. Hand tools.....		2	1	164	167	167
4. Stepping on nail.....				19	19	19
5. Electricity:						
(a) Direct contact with trolley wire.....				1	1	1
(b) Bar or tool striking trolley wire.....						
(c) Contact with motor.....	1			2	2	3
(d) Others.....	1			14	14	15
6. Falls of persons.....	6		6	177	183	189
7. Falling objects (rocks, timbers, etc.).....			5	158	163	163
8. Flying objects:						
(a) From sledging.....			2	80	82	82
(b) From crushing.....				21	21	21
(c) Others.....			2	134	136	136
9. Handling materials:						
(a) Handling rock by hand.....	1		4	167	171	172
(b) Handling other materials.....			6	144	150	150
10. Burns.....	2			117	117	119
11. Other causes.....	2			251	251	253
Total, at outside works.....	22	3	67	1,829	1,899	1,921
Grand total.....	82	5	153	4,869	5,027	5,109

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, 1938

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	21.95	31.03	0.135	0.375	4.81	8.26	1.809	5.034
2. Handling materials	3.66	5.17	.023	.062	17.07	29.29	6.414	17.850
3. Hand tools					3.78	6.49	1.420	3.953
4. Explosives	10.97	15.52	.067	.187	1.01	1.74	.381	1.061
5. Haulage	7.32	10.35	.045	.125	3.56	6.11	1.338	3.724
6. Falls of persons	7.32	10.35	.045	.125	5.99	10.28	2.250	6.262
7. Falling objects (other than 1 and 2)	1.22	1.72	.007	.021	1.97	3.38	.740	2.059
8. Flying objects					7.30	12.53	2.744	7.635
9. Electricity	4.88	6.90	.030	.083	.30	.51	.112	.312
10. Drilling and channeling (by machine or hand)					3.28	5.63	1.234	3.433
11. Machinery	8.53	12.07	.052	.146	3.78	6.49	1.421	3.953
12. Stepping on nail					.32	.55	.120	.333
13. Boiler and air-tank explosions					1.02	.03	.007	.021
14. Burns	1.22	1.72	.007	.021	1.15	1.98	.434	1.207
15. Other causes	3.66	5.17	.023	.062	3.92	6.73	1.473	4.098
Total	70.73	100.00	.434	1.207	58.26	100.00	21.897	60.935
Underground quarry:								
1. Fall of rock from roof or wall					.63	16.50	.239	7.823
2. Rock while loading at working face or chute					1.21	31.44	.456	14.913
3. Hand tools					.16	4.12	.060	1.956
4. Explosives	1.22	50.00	.007	.244	.08	2.06	.030	.978
5. Haulage	1.22	50.00	.007	.244	.32	8.25	.120	3.912
6. Falling down chute, winze, raise, or slope					.16	4.12	.060	1.956
7. Run of rock from chute or pocket					.34	8.76	.127	4.156
8. Drilling								
9. Electricity								
10. Machinery (other than locomotives or drills)					.14	3.61	.052	1.711
11. Mine fires								
12. Suffocation from natural gases								
13. Inrush of water								
14. Stepping on nail					.12	3.09	.045	1.467
15. Handling materials (other than rock)					.18	4.64	.067	2.200
16. Other causes					.52	13.40	.194	6.356
Total underground (excluding shaft)	2.44	100.00	.015	.489	3.86	100.00	1.450	47.428
Shaft or slope:								
17. Falling down shaft or slope								
18. Objects falling down shaft or slope					.02	20.00	.007	.244
19. Breaking of cables					.04	40.00	.015	.489
20. Overwinding								
21. Cage, skip, or bucket					.04	40.00	.015	.489
22. Other causes								
Total shaft					.10	100.00	.037	1.222
At outside works:								
1. Haulage	2.44	9.09	.015	.025	2.51	6.64	.942	1.544
2. Machinery	8.53	31.82	.052	.085	5.89	15.59	2.213	3.627
3. Hand tools					3.32	8.79	1.248	2.046
4. Stepping on nail					.38	1.00	.142	.233
5. Electricity	2.44	9.09	.015	.025	.34	.89	.127	.208
6. Falls of persons	7.32	27.27	.045	.073	3.64	9.64	1.368	2.242

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, 1938—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—Continued.								
7. Falling objects (rocks, timbers, etc.).....					3.24	8.58	1.219	1.997
8. Flying objects.....					4.75	12.59	1.787	2.929
9. Handling materials.....	1.22	4.55	.007	.012	6.39	16.90	2.400	3.934
10. Burns.....	2.44	9.09	.015	.025	2.33	6.16	.875	1.434
11. Other causes.....	2.44	9.09	.015	.025	4.99	13.22	1.876	3.076
Total.....	26.83	100.00	.164	.270	37.78	100.00	14.197	23.270
Grand total.....	100.00		.613		100.00		37.581	

ACCIDENTS AT DIFFERENT KINDS OF QUARRIES

Cement rock.—For a number of years the cement industry has been foremost among the major industries in the United States in safeguarding its employees from accidents resulting from the hazards to which the employees are exposed while performing their daily work. Of the various kinds of quarrying, the cement industry again had the lowest accident-frequency rate in 1938.

Reports from operating companies showed that 181 plants were active in 1938. This number includes a few mills or other plants not operated in direct connection with quarries. Employment was slightly less than in 1937, both in number of men working and number of man-hours worked. The reports for 1938 showed 25,520 employees and a total of 48.5 million man-hours of labor performed. Operations in 1938 averaged 255 days or 1,901 hours per man, and an average workday comprised 7.44 hours. Accidents were responsible for 14 deaths and 470 nonfatal lost-time injuries among the workers. Eight fatalities occurred among quarry employees, four being caused by falls or slides of rock or overburden, three by electricity, and one from fall of person. Six fatalities occurred among employees outside the quarries, of which four were due to machinery accidents, one to electricity, and one to fall of person. Nonfatal injuries at the quarries were caused mainly by handling materials, hand tools, haulage, and falls of persons; those at the mills or other outside plants were due chiefly to machinery, falls of persons, and handling materials. (See tables 13, 14, 16, 17, and 36.)

The accident-frequency rate for cement mills and quarries was 9.98 per million man-hours of exposure to risk. That this rate reflected much credit upon the accident-prevention program of the cement industry is indicated by the fact that the corresponding rate for all kinds of quarries was 38.19. The cement rate for 1937 was 12.17.

A segregation of the 1938 figures for cement plants showed an accident-frequency rate of only 8.19 per million man-hours worked at

the mills and a rate of 21.78 for the quarries. Each of these figures represented an improvement over the record for 1937, which showed a mill rate of 9.55 and a quarry rate of 28.10 for cement plants.

Granite.—Employment at granite quarries was less in 1938 than in 1937, both as to the number of men employed and total number of man-hours worked. Measured by the number of man-hours worked, employment was 13 percent below 1937. A decrease likewise occurred in the length of the work year, which averaged 214 days per employee in 1938 compared with 226 days in 1937. A total of 8,395 employees was reported for 1938, and the total volume of employment for the entire group was 14 million man-hours.

Accidents in and about the quarries and at the finishing or other outside plants resulted in the death of 25 men and in injury to 578. The fatality rate was 1.78 and the nonfatal-injury rate 41.15 per million man-hours of exposure to risk. The combined rate, 42.93, was much more favorable than the 1937 combined rate—54.04. Progress in accident prevention, as represented by the lower accident-frequency rate for 1938, was accomplished by reducing the quarry-accident rates for handling materials, falls of persons, flying objects, and machinery, and by reducing the rates at plants outside the quarries for accidents caused by flying objects, handling materials, and falling objects.

Dimension-stone quarries employed 2,619 persons at quarries and 2,551 at finishing and other outside plants; in this group the States having the largest number of employees were Maine, Minnesota, Vermont, Massachusetts, and Georgia. Nondimension-stone quarries reported 1,747 employees at quarries and 641 at crushers or engaged on other work outside the quarries. The principal States—those having the largest number of men working at nondimension-granite quarries—were North Carolina, Montana, South Carolina, and Georgia. In addition, 562 workers at quarries and 275 employees outside the quarries were reported at plants whose operating companies did not indicate clearly the chief use for which the stone was produced.

Limestone.—Limestone quarries, excluding those producing stone chiefly for the manufacture of cement or lime, employed 22,352 men in 1938, a decrease of 10 percent from 1937. The number of man-hours worked declined 18 percent, being 33.5 million compared with 40.7 million in 1937. The average employee had 187 days of work, 15 days less than in 1937. About 64 percent of the men worked in and about the quarries and 36 percent outside the quarries at crushers, at sawing and finishing plants, or on other work.

Twenty-two employees were killed and 1,892 injured by accidents at the quarries and outside plants. The accident-frequency rate was 57.12 (0.66 for fatalities and 56.46 for nonfatal injuries) compared with 53.92 for 1937. The main causes of accidents are shown in tables 14 and 15. The slight increase in the frequency rate for 1938 was due chiefly to increases in accidents caused by handling materials, flying objects, and falls of persons.

Limestone quarries producing stone intended for use in monumental, building, or other dimension form employed 2,419 men, of whom 912 worked in quarrying and 1,507 at sawing and finishing plants. About two-thirds of the total number of men worked at quarries in Indiana. Reports from nondimension-limestone producers, not

including producers of cement and lime, showed a total of 19,447 employees, of whom 13,082 worked at the quarries and 6,365 at crushers or other outside plants. Pennsylvania employed the largest number of men at operations of this type, other leading States being Illinois, New York, Ohio, Michigan, Missouri, and Kentucky. In addition, 486 employees, of whom 422 were quarry workers and 64 "outside" workers, worked at plants whose reports to the Bureau of Mines did not indicate the chief use for which the stone was quarried.

Limestone (chief product, lime).—Quarries that produced limestone chiefly for the manufacture of lime reported a reduction in number of employees and in total man-hours worked in 1938 compared with 1937. The number of employees at the quarries and kilns was 9,153, a reduction of 1,207, and the total amount of labor reported was 18.1 million man-hours, a decrease of 20 percent. Working time per employee averaged 260 days, 21 days less per man than in 1937. The weighted average length of shift was 7.6 hours, almost the same (7.7) as in the previous year.

Fourteen men were killed and 936 men were injured by accidents. These figures indicate a fatality rate of 0.77 and an injury rate of 51.74 per million man-hours of employment or exposure to industrial hazards. A slight improvement was indicated by the injury rate for 1938, as the rate for the previous year was 54.21, but the fatality rate was higher than that for 1937. Most of the improvement in 1938 was due to a decrease in accidents from handling materials, falls of persons, falling objects, and machinery.

On the basis of number of employees about one-third of the lime industry was in Ohio and Pennsylvania, the former State having 1,851 employees and the latter 1,564. Other States with 500 or more employees at the quarries and kilns were Virginia, Missouri, Tennessee, and West Virginia.

Marble.—Employment at marble quarries was about 5 percent less in 1938 than in 1937, measured by the total number of man-hours worked or by the total number of employees, although a slight gain (4 days) was made in the average number of workdays per employee. An increase in the number of accidents, together with the decline in the total number of man-hours worked, resulted in a rise in the accident-frequency rate per million man-hours worked.

Reports from operating companies showed that 61 plants were active in 1938 and that 3,414 men were employed. The average employee had 234 days of work, amounting to 1,921 hours, the total number of man-hours worked by all employees being 6.56 million. One employee was killed by an accident, and 382 employees were injured; thus the accident-frequency rate was 58.39 per million man-hours of exposure to risk. This rate compared with 50.92 for 1937 and represented an increase of 15 percent. The principal causes of the accidents are shown in table 14. The rise in the rate for 1938 was due chiefly to increases in accidents from hand tools, falls of persons, falling objects, flying objects, drilling and channeling, machinery, and burns. (See table 26.)

Tennessee was the principal State from the standpoint of number of men working at marble quarries, and Vermont ranked second.

Nearly all (91 percent) of the men employed at marble quarries worked at plants where the stone produced was to be used in dimension

form. Plants employing about 5 percent of the total number of workers did not indicate the form in which the stone produced was to be used.

Sandstone.—Reports from companies operating sandstone quarries showed that 181 plants were active in 1938 and that 2,907 men were employed for an average of 182 days per man. Quarry operations proper had 2,045 employees and work outside the quarries 862. Plants that produced stone to be crushed or used in other nondimension form reported 1,723 employees, of whom 1,299 worked in and about the quarries. Reports from dimension-stone plants showed a total of 1,085 employees, of whom 650 worked in the quarries. Ninety-nine men were employed at plants whose reports did not indicate definitely the form in which the stone was intended for use. Of the 99 men, all but 3 worked at the quarries.

The total volume of labor performed at all active plants was 4,333,529 man-hours, a reduction of 21 percent from 1937. The number of employees was 335 less than the number working in 1937.

Accidents during 1938 resulted in injury to 252 employees. None of the accidents were fatal. In the previous year 4 men were killed, and 411 were injured. These figures represent a better safety record for 1938 than for 1937. The accident-frequency rate was 58.15 per million man-hours worked in 1938 compared with 75.31 in 1937, or 23 percent lower in 1938. The improvement indicated by the 1938 rate was effected mainly through a reduction in accidents caused by hand tools, flying objects, and haulage in the quarries and by machinery, hand tools, and flying objects in work at plants outside the quarries. (See tables 24, 25, 26, 27, 41, and 42.)

Slate.—Eighty-three slate quarries were active in 1938 according to reports received from operating companies by the Bureau of Mines. These quarries, together with their sawing and finishing or other outside plants, employed 2,615 men, the average working period per man being 195 days. A total of nearly 4.3 million man-hours was worked by the employees. The number of men employed in 1938 represented a decrease of 459 compared with 1937, and the total number of man-hours worked a decrease of 29 percent. Accidents killed 1 man and injured 243; thus the accident-frequency rate was 57.04 compared with 56.93 in 1937. Although the gross rates for the 2 years were virtually equal, certain classes of accidents changed in frequency. Higher rates were reported in 1938 for accidents caused by handling materials and hand tools in work inside the quarries and by machinery and hand tools in work outside the quarries. Higher rates were also reported at underground quarries for accidents caused by falls of rock from the roof or wall, hand tools, haulage, run of rock from chute or pocket, and drilling. Reduced rates in 1938 were reported for accidents from falls or slides of rock or overburden, falling objects, and flying objects inside the quarries and from haulage, falls of persons, and handling materials outside the quarries.

About half of the total number of employees at slate quarries were reported by plants in Pennsylvania, with Vermont and Virginia occupying second and third place, respectively. Nearly all of the employees worked at plants that produced slate for use in dimension form; 2,129 employees were so reported compared with 346 employees

at plants where the slate was crushed or ground and 140 at plants whose reports did not indicate how the slate was to be used. (See tables 16, 17, 26, 27, 41, and 42.)

Trap rock.—An increase in the number of men employed in 1938 was shown by reports from companies engaged in the production of trap rock. Employees at all plants numbered 3,141, a gain of 335 over 1937. The total volume of labor was 4.4 million man-hours, virtually the same as in 1937. No single State was conspicuous as leader in number of men employed, although New Jersey had more employees than any other State. Ranking next to New Jersey were Washington, Oregon, Pennsylvania, and Massachusetts, each with 300 or more employees. Of the total number of workers, 2,066 were employed in the quarries and 1,075 outside the quarries. The average working time per employee was 176 days compared with 192 days in 1937.

Accidents in 1938 killed 5 employees and injured 274 and represented an accident-frequency rate of 62.85 per million man-hours worked. This rate showed an improvement over 1937 when the rate was 75.76. The lowering of the rate in 1938 was due mainly to a reduction in accidents caused by handling materials, falls of persons, and drilling and channeling in quarry operations and to a decrease in accidents at underground quarries.

Virtually all trap-rock quarries that were active in 1938 were producing stone to be used in nondimension form. (See tables 16, 17, 26, 27, 41, and 42.)

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, 1938

Kind of quarry	Num-ber of quar-ries ¹	Men employed			Man-days of employment			Average hours of employment per man per day			Man-hours of employment		
		At quarry		Total	At quarry		Total	At quarry		Total	At quarry		Total
		At out-side works	At quarry	Total	At out-side works	At quarry	Total	At out-side works	At quarry	Total	At out-side works	At quarry	Total
Cement rock.....	181	3,874	21,646	25,520	843,150	5,672,710	6,515,860	7.57	7.43	7.44	6,381,332	42,126,292	48,507,624
Granite.....	306	4,928	3,467	8,395	1,045,587	753,228	1,798,815	7.70	7.96	7.81	8,046,619	5,998,374	14,044,993
Limestone.....	909	14,416	7,936	22,352	2,603,904	1,570,571	4,174,475	7.97	8.12	8.03	20,765,959	12,746,989	33,512,948
Limestone (chief product, lime).....	260	3,667	5,486	9,153	915,132	1,460,394	2,375,526	7.60	7.62	7.62	6,951,358	11,140,144	18,091,502
Marble.....	61	1,305	2,109	3,414	291,257	508,728	799,985	8.45	8.05	8.20	2,462,084	4,096,528	6,558,612
Sandstone.....	181	2,045	862	2,907	352,297	176,222	528,519	8.14	8.31	8.20	2,868,458	1,465,071	4,333,529
Slate.....	83	1,043	1,572	2,615	202,096	308,623	510,719	8.44	8.33	8.38	1,706,300	2,571,387	4,277,687
Trap rock.....	155	2,066	1,075	3,141	370,488	181,441	551,929	8.03	8.06	8.04	2,975,990	1,463,276	4,439,266
Total.....	2,136	33,344	44,153	77,497	6,623,911	10,631,917	17,255,828	7.87	7.68	7.75	52,198,050	81,608,061	133,766,111

Kind of quarry	Average hours of employment per man			Number killed			Number injured			Rates per million man-hours								
	At quarry		Total	At quarry		Total	At quarry		Total	At quarry		Total						
	At out-side works	At quarry	Total	At out-side works	At quarry	Total	At out-side works	At quarry	Total	At out-side works	At quarry	Total						
Cement rock.....	218	262	255	1,647	1,946	1,601	8	6	14	131	339	470	1.25	0.14	0.29	20.53	8.05	9.69
Granite.....	212	217	214	1,633	1,730	1,573	23	2	25	395	183	578	13	20	1.78	49.09	30.51	41.15
Limestone.....	181	198	187	1,440	1,606	1,499	16	6	22	1,379	513	1,892	15	17	.47	66.41	40.24	56.46
Limestone (chief product, lime).....	250	266	260	1,896	2,031	1,977	7	7	14	509	427	935	8	8	.63	73.22	38.33	51.74
Marble.....	223	241	234	1,887	1,942	1,921	1	1	1	190	192	382	1	1	.41	70.77	46.87	58.24
Sandstone.....	172	204	182	1,403	1,700	1,491	1	1	2	203	49	252	1	1	.59	70.77	33.45	58.15
Slate.....	194	186	195	1,636	1,636	1,636	1	1	1	108	135	243	1	1	.23	63.29	52.50	56.81
Trap rock.....	179	169	176	1,440	1,361	1,413	4	1	5	213	61	274	4	6	.68	71.57	41.69	61.72
Total.....	199	241	223	1,564	1,848	1,726	60	22	82	3,128	1,899	5,027	55	77	1.15	59.97	23.27	37.58

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, 1938

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 channeled (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 chute at working face or chute	Hand tools	Explosives	Haulage	Falling down chute, slope, raise, or	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.....	4					1			3							8											
Granite.....	9	3		6	1		1			3						23											
Limestone.....	4			1	4	2				3				1	1	16											
Limestone (chief product, lime).....					2	2			1							5			1	1							
Marble.....						1										1											
Sandstone.....						1										1											
Slate.....						1										1											
Trap rock.....	1					1				1						4											
Total.....	18	3		9	6	6	1	4		7				1	3	58				1	1						
Injured:	7	20	10	2	9	9	4	42	3	6				2	1	73	3	16	1	2	2		5	6		3	
Cement rock.....	25	107	24	8	22	42	17	42	41	35	4	4		4	22	383							2	2			
Granite.....	110	371	79	18	81	123	44	198	66	88	4	4		31	85	1,308	10	22	2	1	9		2	8		1	
Limestone.....																											
Limestone (chief product, lime).....	51	166	26	16	45	37	5	42	10	8	8	5		9	39	460	14	21	2	4						3	
Marble.....	8	21	24	1	2	20	11	32	18	13	2	2	1	7	23	183											
Sandstone.....	8	64	14	1	12	20	11	21	3	12	17			2	18	203								1			
Slate.....	8	52	5	2	4	10	1	3	1	2	6	1		2	97	4							1				
Trap rock.....	25	57	8	3	4	40	6	29	13	17				3	7	212	1										
Total.....	242	868	190	51	179	301	99	367	15	165	190	16	1	58	197	2,929	32	61	8	4	16		8	17		7	

Temporary: ³	3	15	1	1	1	5	6	3				3	12	50	1	2	2	5
Cement rock.....																		
Granite.....	9	22	2	9	2	8	1	1				2	5	69				
Limestone.....	14	20	2	4			3					4	1	48				
Limestone (chief product, lime).....		1	1										3	6				
Marble.....																		
Sandstone.....	4		1	1	1	1	1						1	10				
Slate.....	1													1				
Trap rock.....																		
Total.....	31	58	7	2	15	8	16	7				6	9	185		1	2	5
All quarries:																		
Killed.....					1	1								2				
Permanent total ¹																		
Permanent partial ²	1	3	1	2	1	1								9				
Temporary ³	31	58	7	2	15	8	16	7				6	9	185		1	2	5
Total, nonfatal.....	32	61	8	4	16	8	17	7				6	9	194		1	2	5

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, 1938

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	11	216	855	1,071	52,364	213,119	265,483	242	249	248
California	10	335	1,386	1,721	88,705	450,679	539,384	265	325	313
Illinois	6	188	1,073	1,261	41,312	266,138	307,450	220	248	244
Indiana	5	82	994	1,076	19,052	250,186	269,238	232	252	250
Iowa	5	173	1,031	1,204	39,048	284,765	323,813	226	276	269
Kansas	8	129	759	888	28,834	199,902	228,736	224	263	258
Michigan	12	107	1,365	1,472	28,332	386,260	414,592	265	283	282
Missouri	5	221	865	1,086	41,572	264,153	305,725	188	305	282
New York	14	276	1,344	1,620	53,110	311,455	364,565	192	232	225
Ohio	11	205	1,230	1,435	46,517	312,623	359,140	227	254	250
Pennsylvania	32	797	4,537	5,334	153,042	1,146,153	1,299,195	192	253	244
Tennessee	6	109	575	684	27,883	135,722	163,605	256	236	239
Texas	11	135	1,254	1,389	29,719	337,401	367,120	220	269	264
Virginia	3	123	333	456	25,679	96,003	121,682	209	288	267
Washington	6	110	415	525	17,186	95,916	113,102	156	231	215
West Virginia	3	137	283	420	34,533	64,935	99,468	252	229	237
Other States ²	33	531	3,347	3,878	116,262	857,300	973,562	219	256	251
Total	181	3,874	21,646	25,520	843,150	5,672,710	6,515,860	218	262	255
Marble:										
Alabama	3	71	151	222	17,683	38,532	56,215	249	255	253
Missouri	5	101	151	252	25,502	39,474	64,976	252	261	258
Tennessee	16	715	473	1,188	171,344	126,785	298,129	240	268	251
Vermont	7	183	709	892	44,406	179,016	223,422	243	252	250
Other States ³	30	235	625	860	32,322	124,921	157,243	138	200	183
Total	61	1,305	2,109	3,414	291,257	508,728	799,985	223	241	234
Slate:										
New York	7	43	29	72	5,894	5,634	11,528	137	194	160
Pennsylvania	29	462	872	1,334	94,453	179,858	274,311	204	206	206
Vermont	28	307	273	580	67,769	63,624	131,393	221	233	227
Virginia	6	133	245	378	19,513	33,723	53,236	147	138	141
Other States ⁴	13	98	153	251	14,467	25,784	40,251	148	169	160
Total	83	1,043	1,572	2,615	202,096	308,623	510,719	194	196	195
Trap rock:										
California	19	114	118	232	23,887	25,128	49,015	210	213	211
Connecticut	14	190	82	272	48,022	19,425	67,447	253	237	248
Maryland	8	103	29	132	20,845	5,480	26,325	202	189	199
Massachusetts	13	221	82	303	41,733	15,685	57,418	189	191	189
Michigan	3	137	15	152	24,052	1,130	25,182	176	75	166
New Jersey	20	304	160	464	64,442	32,338	96,780	212	202	209
New York	3	82	62	144	17,596	17,055	34,651	215	275	241
Oregon	20	155	176	331	14,652	12,679	27,331	95	72	83
Pennsylvania	17	170	141	311	34,026	29,546	63,572	200	210	204
Virginia	6	75	16	91	9,771	1,644	11,415	130	103	125
Washington	22	374	31	405	57,324	3,503	60,827	153	113	150
Other States ⁵	10	141	163	304	14,138	17,828	31,966	100	109	105
Total	155	2,066	1,075	3,141	370,488	181,441	551,929	179	169	176

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 Arizona, Arkansas, California, Colorado, Georgia, Maryland, Massachusetts, Montana, New York, North Carolina, Oklahoma, Pennsylvania, Virginia, Washington, and Wisconsin.

⁴ Includes Arkansas, California, Georgia, Maine, Maryland, Massachusetts, New Jersey, and Tennessee.

⁵ Includes Idaho, Maine, 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, 1938

State	Man-hours of employment			Number killed			Number injured			Wkds	Orphans
	At quarry	At outside works	Total	At quarry	At outside works	Total	At quarry	At outside works	Total		
Cement rock:											
Alabama	401, 277	1, 540, 906	1, 942, 183	1	2	3	1	7	8	2	3
California	693, 327	3, 447, 469	4, 140, 796	1	1	2	55	106	161	2	3
Illinois	278, 177	1, 707, 615	1, 985, 792				2	3	5		
Indiana	123, 290	1, 811, 593	1, 934, 883					1	1		
Iowa	312, 896	2, 106, 788	2, 419, 684	1		1	4	8	12	1	
Kansas	205, 553	1, 551, 410	1, 756, 963	2		2	3	3	6	2	4
Michigan	220, 616	3, 083, 284	3, 303, 900		1	1	3	15	18	1	1
Missouri	305, 272	1, 801, 477	2, 106, 749				2	3	5		
New York	400, 804	2, 483, 295	2, 884, 099	1		1	1	9	10	1	4
Ohio	357, 177	2, 411, 372	2, 768, 549		1	1	5	15	20	1	3
Pennsylvania	1, 209, 377	8, 242, 649	9, 452, 026	1	1	2	10	35	45	2	2
Tennessee	223, 118	1, 063, 625	1, 286, 743					2	9	11	
Texas	218, 738	2, 583, 851	2, 802, 589				1	22	23		
Virginia	179, 439	636, 412	815, 851					4	4		
Washington	138, 960	731, 679	870, 639	1		1	7	6	13	1	1
West Virginia	268, 981	496, 213	765, 194					8	9		
Other States ¹	844, 330	6, 426, 654	7, 270, 984				27	84	111		
Total	6, 381, 332	42, 126, 292	48, 507, 624	8	6	14	131	339	470	13	20
Marble:											
Alabama	145, 272	310, 944	456, 216				29	19	48		
Missouri	204, 016	313, 226	517, 242				11	12	23		
Tennessee	1, 500, 594	1, 063, 407	2, 564, 001				137	72	209		
Vermont	355, 248	1, 431, 768	1, 787, 016				10	37	47		
Other States ²	256, 904	977, 183	1, 234, 087	1		1	3	52	55		
Total	2, 462, 034	4, 096, 528	6, 558, 562	1		1	190	192	382		
Slate:											
New York	49, 162	49, 956	99, 118				2	3	5		
Pennsylvania	768, 534	1, 446, 705	2, 215, 239	1		1	61	82	143	1	
Vermont	593, 056	551, 954	1, 145, 010				22	30	52		
Virginia	173, 622	302, 654	476, 276				10	6	16		
Other States ³	121, 926	220, 118	342, 044				13	14	27		
Total	1, 706, 300	2, 571, 387	4, 277, 687	1		1	108	135	243	1	
Trap rock:											
California	191, 775	201, 439	393, 214				19	11	30		
Connecticut	400, 802	166, 043	566, 845				14	13	27		
Maryland	177, 915	46, 295	224, 210				9	2	11		
Massachusetts	347, 999	131, 472	479, 471	1		1	16	5	21		
Michigan	192, 416	9, 040	201, 456				27		27		
New Jersey	525, 520	272, 892	798, 412				29	8	37		
New York	114, 516	136, 279	250, 795	1		1	7	6	13	1	2
Oregon	81, 265	89, 965	204, 481				16	10	26		
Pennsylvania	282, 679	250, 964	533, 643		1	1	18	4	22	1	
Virginia	81, 265	14, 179	95, 444								
Washington	402, 891	27, 900	430, 791	2		2	29	2	31	2	4
Other States ⁴	107, 946	116, 808	224, 754				29		29		
Total	2, 975, 990	1, 463, 276	4, 439, 266	4	1	5	213	61	274	4	6

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 Arizona, Arkansas, California, Colorado, Georgia, Maryland, Massachusetts, Montana, New York, North Carolina, Oklahoma, Pennsylvania, Virginia, Washington, and Wisconsin.

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

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

TABLE 18.—Granite quarries: Men employed and man-days, by States, during the year ended Dec. 31, 1938

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.....	31	553	217	770	129,104	52,340	181,444	233	241	236
Connecticut.....	10	64	72	136	13,819	17,568	31,387	216	244	231
Georgia.....	21	468	352	820	123,549	81,713	205,262	264	232	250
Maine.....	18	362	494	856	39,075	56,204	95,279	108	114	111
Maryland.....	10	124	10	134	26,969	1,591	28,560	217	159	213
Massachusetts.....	26	311	347	658	55,222	76,986	132,208	178	222	201
Minnesota.....	32	216	501	717	50,620	131,958	182,578	234	263	255
Montana.....	7	458	3	461	102,815	47	102,862	224	16	223
New Hampshire.....	12	161	194	355	18,350	38,012	56,362	114	196	159
New York.....	4	150	40	190	28,911	8,189	37,100	193	205	195
North Carolina.....	17	509	346	855	122,462	91,046	213,508	241	263	250
Oklahoma.....	8	98	65	163	26,162	15,244	41,406	267	235	254
Pennsylvania.....	18	113	70	183	25,096	15,720	41,716	230	225	228
Rhode Island.....	6	49	89	138	10,450	20,243	30,693	213	227	222
South Carolina.....	6	196	157	353	51,389	40,132	91,521	262	256	259
South Dakota.....	6	59	67	126	14,421	15,576	29,997	244	232	238
Texas.....	7	40	16	56	8,308	3,906	12,214	208	244	218
Vermont.....	11	579	41	620	124,717	6,950	131,667	215	170	212
Virginia.....	8	156	93	249	31,706	22,771	54,477	203	245	219
Wisconsin.....	17	135	204	339	25,977	35,746	61,723	192	175	182
Other States ²	31	127	89	216	15,565	21,286	36,851	123	239	171
Total.....	306	4,928	3,467	8,395	1,045,587	753,228	1,798,815	212	217	214

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

TABLE 19.—Granite quarries: Man-hours and number killed and injured, by States, during the year ended Dec. 31, 1938

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.....	738,649	310,690	1,049,339	3	-----	3	18	8	26	2	-----
Connecticut.....	110,550	140,544	251,094	1	-----	1	5	7	12	1	-----
Georgia.....	1,002,902	667,533	1,670,435	-----	1	1	60	17	77	-----	-----
Maine.....	310,914	443,386	754,300	1	-----	1	21	4	25	-----	-----
Maryland.....	224,609	14,674	239,283	-----	-----	-----	14	-----	14	-----	-----
Massachusetts.....	440,662	615,890	1,056,552	-----	-----	-----	14	14	28	-----	-----
Minnesota.....	398,280	1,056,787	1,455,067	1	1	2	13	34	47	1	1
Montana.....	822,526	376	822,902	5	-----	5	24	-----	24	3	9
New Hampshire.....	142,313	301,866	444,179	1	-----	1	15	11	26	1	-----
New York.....	231,288	65,512	296,800	1	-----	1	7	8	15	-----	-----
North Carolina.....	999,211	747,401	1,746,612	5	-----	5	32	11	43	4	3
Oklahoma.....	209,296	121,952	331,248	-----	-----	-----	4	5	9	-----	-----
Pennsylvania.....	214,224	125,762	339,986	-----	-----	-----	16	8	24	-----	-----
Rhode Island.....	83,596	161,944	245,540	-----	-----	-----	4	3	7	-----	-----
South Carolina.....	431,474	347,064	778,538	2	-----	2	41	10	51	1	4
South Dakota.....	115,368	124,608	239,976	-----	-----	-----	9	4	13	-----	-----
Texas.....	72,841	33,986	106,827	-----	-----	-----	-----	2	2	-----	-----
Vermont.....	880,546	50,634	931,180	3	-----	3	53	-----	53	2	-----
Virginia.....	274,166	196,496	470,662	-----	-----	-----	13	4	17	-----	-----
Wisconsin.....	214,219	286,609	500,828	-----	-----	-----	18	20	38	-----	-----
Other States ¹	128,985	184,660	313,645	-----	-----	-----	14	13	27	-----	-----
Total.....	8,046,619	5,998,374	14,044,993	23	2	25	395	183	578	15	17

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

TABLE 20.—Limestone quarries: Men employed and man-days, by States, during the year ended Dec. 31, 1938

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.....	9	438	309	747	85,168	68,591	153,759	194	222	206
California.....	14	359	141	500	80,811	29,185	109,996	225	207	220
Colorado.....	8	102	14	116	16,042	1,747	17,789	157	125	153
Florida.....	23	394	236	630	68,457	46,201	114,658	174	196	182
Georgia.....	6	32	46	78	3,391	4,162	7,553	106	90	97
Illinois.....	65	1,886	616	2,502	386,048	119,276	505,324	205	194	202
Indiana.....	88	1,121	1,437	2,558	192,052	277,657	469,709	171	193	184
Iowa.....	43	351	116	467	49,468	17,543	67,011	141	151	143
Kansas.....	28	335	82	417	55,800	13,274	69,074	167	162	166
Kentucky.....	37	815	293	1,108	139,864	54,052	193,916	172	184	175
Maryland.....	12	82	23	105	15,281	4,409	19,690	186	192	188
Massachusetts.....	4	37	36	73	7,318	9,667	16,985	198	260	233
Michigan.....	14	734	624	1,358	128,579	125,355	253,934	175	201	187
Minnesota.....	18	187	128	315	21,838	19,971	41,809	117	156	133
Missouri.....	70	1,047	241	1,288	150,534	42,068	192,602	144	175	150
Montana.....	5	57	1	58	11,495	30	11,525	202	30	199
Nebraska.....	5	50	17	67	9,632	3,716	13,348	193	219	199
New York.....	58	1,056	651	1,707	204,478	125,484	329,962	194	193	193
Ohio.....	102	933	582	1,515	162,949	117,984	280,933	175	203	185
Oklahoma.....	10	182	49	231	36,639	10,512	47,151	201	215	204
Pennsylvania.....	137	2,068	1,316	3,384	342,568	264,870	607,438	166	201	180
Tennessee.....	21	264	130	394	55,070	26,518	81,588	209	204	207
Texas.....	15	227	214	441	55,265	45,766	101,031	243	214	229
Utah.....	4	43	14	57	6,629	2,891	9,520	154	207	167
Virginia.....	30	607	315	922	143,288	81,576	224,864	236	259	244
West Virginia.....	10	223	83	306	38,146	17,086	55,232	171	206	180
Wisconsin.....	40	351	106	457	60,563	14,370	74,933	173	136	164
Wyoming.....	5	100	20	120	17,375	3,866	21,241	174	193	177
Other States ²	28	335	96	431	59,156	22,744	81,900	177	237	190
Total.....	909	14,416	7,936	22,352	2,603,904	1,570,571	4,174,475	181	198	187

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

² Includes Arizona, Arkansas, Connecticut, Idaho, Louisiana, Maine, Mississippi, Nevada, New Jersey, New Mexico, North Carolina, South Carolina, South Dakota, Vermont, and Washington.

TABLE 21.—Limestone quarries: Man-hours and number killed and injured, by States, during the year ended Dec. 31, 1938

State	Man-hours of employment			Number killed			Number injured			Wid- ows	Or- phans
	At quarry	At outside works	Total	At quarry	At out- side works	Total	At quarry	At out- side works	Total		
Alabama.....	688, 918	556, 201	1, 245, 119	1	-----	1	53	19	72	-----	-----
California.....	646, 446	233, 041	879, 487	1	-----	1	28	8	36	1	1
Colorado.....	127, 198	13, 691	140, 889	-----	-----	-----	13	-----	13	-----	-----
Florida.....	609, 368	403, 530	1, 012, 898	-----	-----	-----	42	37	79	-----	-----
Georgia.....	26, 653	32, 332	58, 985	-----	-----	-----	10	5	15	-----	-----
Illinois.....	2, 458, 044	823, 243	3, 281, 287	2	-----	2	92	16	108	1	2
Indiana.....	1, 570, 894	2, 261, 379	3, 832, 273	2	1	3	99	101	200	3	4
Iowa.....	420, 358	152, 729	573, 087	-----	-----	-----	28	7	35	-----	-----
Kansas.....	432, 629	101, 904	534, 533	-----	-----	-----	30	3	33	-----	-----
Kentucky.....	1, 269, 270	509, 123	1, 778, 393	-----	-----	-----	117	30	147	-----	-----
Maryland.....	132, 877	39, 372	172, 249	-----	-----	-----	9	-----	9	-----	-----
Massachusetts.....	59, 270	78, 303	137, 573	-----	-----	-----	9	6	15	-----	-----
Michigan.....	1, 035, 169	1, 003, 850	2, 039, 019	1	-----	1	25	24	49	1	-----
Minnesota.....	181, 724	162, 667	344, 391	-----	-----	-----	17	7	24	-----	-----
Missouri.....	1, 085, 028	321, 759	1, 406, 787	2	-----	2	131	15	146	2	4
Montana.....	91, 956	240	92, 196	-----	-----	-----	21	-----	21	-----	-----
Nebraska.....	78, 207	30, 931	109, 138	-----	-----	-----	2	-----	2	-----	-----
New York.....	1, 699, 017	1, 016, 151	2, 715, 168	1	1	2	70	36	106	1	4
Ohio.....	1, 353, 203	980, 906	2, 334, 109	-----	2	2	66	50	116	1	5
Oklahoma.....	298, 508	86, 790	385, 298	-----	-----	-----	26	4	30	-----	-----
Pennsylvania.....	2, 815, 371	2, 137, 329	4, 952, 700	1	-----	1	169	35	204	-----	-----
Tennessee.....	445, 176	217, 877	663, 053	2	1	3	44	9	53	3	4
Texas.....	456, 958	374, 261	831, 219	2	1	3	29	17	46	1	-----
Utah.....	52, 747	22, 843	75, 590	-----	-----	-----	4	5	9	-----	-----
Virginia.....	1, 274, 320	696, 628	1, 970, 948	-----	-----	-----	81	49	130	-----	-----
West Virginia.....	330, 286	153, 270	483, 556	-----	-----	-----	13	10	23	-----	-----
Wisconsin.....	500, 884	120, 473	621, 357	-----	-----	-----	66	3	69	-----	-----
Wyoming.....	138, 979	30, 936	169, 915	-----	-----	-----	11	3	14	-----	-----
Other States ¹	486, 501	185, 230	671, 731	1	-----	1	74	14	88	-----	2
Total.....	20, 765, 959	12, 746, 989	33, 512, 948	16	6	22	1, 379	513	1, 892	14	26

¹ Includes Arizona, Arkansas, Connecticut, Idaho, Louisiana, Maine, Mississippi, Nevada, New Jersey, New Mexico, North Carolina, South Carolina, South Dakota, Vermont, and Washington.

TABLE 22.—Limestone (chief product, lime) quarries: Men employed and man-days, by States, during the year ended Dec. 31, 1938

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	172	146	318	47,355	42,557	89,912	275	291	283
Arizona.....	4	64	67	131	20,993	22,001	42,994	328	328	328
California.....	8	78	129	207	24,142	38,743	62,885	310	300	304
Florida.....	3	30	56	86	8,078	16,136	24,214	269	288	282
Illinois.....	7	72	117	189	20,449	29,936	50,385	234	256	267
Indiana.....	5	69	105	174	18,738	29,468	48,206	272	281	277
Maryland.....	11	87	58	145	29,206	13,240	56,145	263	228	249
Massachusetts.....	6	73	143	216	19,530	39,534	59,364	268	279	275
Michigan.....	4	19	54	73	2,400	16,725	19,125	126	310	262
Missouri.....	11	357	444	801	80,093	104,694	184,787	224	236	231
New York.....	7	45	76	121	7,733	15,207	22,940	172	200	190
Ohio.....	19	662	1,189	1,851	155,432	338,560	493,992	235	285	267
Pennsylvania.....	65	576	988	1,564	136,479	249,259	385,738	237	252	247
Tennessee.....	11	230	361	591	60,219	93,832	154,051	262	260	261
Texas.....	6	48	106	154	11,577	29,809	41,886	241	281	269
Vermont.....	3	24	36	60	7,558	11,984	19,542	315	333	326
Virginia.....	23	394	454	848	107,440	131,364	238,804	273	289	282
Washington.....	6	76	92	168	17,366	20,863	38,229	229	227	228
West Virginia.....	8	185	340	525	40,969	70,698	111,667	221	208	213
Wisconsin.....	10	86	85	171	21,199	22,816	44,015	247	268	267
Other States ²	35	320	440	760	84,477	122,668	207,145	264	279	273
Total.....	260	3,667	5,486	9,153	915,132	1,460,394	2,375,526	250	266	260

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

² Includes Arkansas, Colorado, Connecticut, Georgia, Idaho, Kentucky, Maine, Minnesota, Montana, Nevada, New Jersey, New Mexico, Oklahoma, Oregon, Rhode Island, South Dakota, and Utah.

TABLE 23.—Limestone (chief product, lime) quarries: Man-hours and number killed and injured, by States, during the year ended Dec. 31, 1938

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			
Alabama.....	321,720	289,820	611,540	-----	-----	-----	18	11	29	-----	-----	
Arizona.....	152,616	156,865	309,481	-----	-----	-----	11	4	15	-----	-----	
California.....	176,324	282,507	458,831	-----	-----	-----	10	19	29	-----	-----	
Florida.....	64,624	124,180	188,804	-----	-----	-----	5	2	7	-----	-----	
Illinois.....	163,588	238,609	402,197	-----	-----	-----	2	6	8	-----	-----	
Indiana.....	123,175	193,007	316,182	1	2	3	2	6	8	-----	-----	
Maryland.....	182,764	108,109	290,873	-----	-----	-----	1	15	16	-----	-----	
Massachusetts.....	137,868	313,107	470,975	-----	1	1	16	6	22	-----	-----	
Michigan.....	19,956	134,556	154,512	-----	-----	-----	21	22	43	1	1	
Missouri.....	609,493	813,172	1,422,665	1	-----	-----	-----	8	8	-----	-----	
New York.....	64,244	122,556	186,800	-----	-----	-----	2	8	10	-----	-----	
Ohio.....	1,162,541	2,479,923	3,642,464	1	-----	1	34	59	93	1	2	
Pennsylvania.....	1,042,782	1,923,865	2,966,647	1	1	2	69	36	105	2	3	
Tennessee.....	473,675	773,778	1,247,453	1	1	2	47	33	80	1	-----	
Texas.....	89,116	250,207	339,323	-----	-----	-----	6	8	14	-----	-----	
Vermont.....	66,714	108,171	174,885	-----	-----	-----	18	20	38	-----	-----	
Virginia.....	855,747	1,068,066	1,923,813	-----	1	1	81	42	123	1	-----	
Washington.....	138,923	166,912	305,835	1	-----	-----	1	16	6	22	1	2
West Virginia.....	283,292	501,720	785,012	-----	-----	-----	5	7	12	-----	-----	
Wisconsin.....	152,358	167,020	319,378	-----	-----	-----	13	14	27	-----	-----	
Other States ¹	649,838	918,994	1,568,832	1	1	2	97	67	164	1	-----	
Total.....	6,951,358	11,140,144	18,091,502	7	7	14	509	427	936	8	8	

¹ Includes Arkansas, Colorado, Connecticut, Georgia, Idaho, Kentucky, Maine, Minnesota, Montana, Nevada, New Jersey, New Mexico, Oklahoma, Oregon, Rhode Island, South Dakota, and Utah.

TABLE 24.—Sandstone quarries: Men employed and man-days, by States, during the year ended Dec. 31, 1938

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.....	16	60	27	87	13,762	7,170	20,932	229	266	241
Colorado.....	8	128	4	132	32,712	731	33,443	256	183	253
New York.....	21	123	50	173	17,831	9,416	27,247	145	188	157
Ohio.....	15	259	324	583	46,270	78,012	124,282	179	241	213
Pennsylvania.....	58	618	156	774	94,908	27,398	122,306	154	176	158
South Dakota.....	5	147	43	190	43,344	6,918	50,262	159	161	159
Tennessee.....	3	27	27	54	7,312	8,108	15,420	271	300	286
West Virginia.....	10	170	93	263	28,211	15,975	44,186	166	172	163
Wisconsin.....	7	118	13	131	25,106	1,577	26,683	213	121	204
Other States ²	38	395	125	520	62,841	20,917	83,758	159	167	161
Total.....	181	2,045	862	2,907	352,297	176,222	528,519	172	204	182

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

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

TABLE 25.—Sandstone quarries: Man-hours and number killed and injured, by States, during the year ended Dec. 31, 1938

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.....	110,064	56,007	166,071	.....	.....	.....	8	5	13	.....	.....
Colorado.....	233,183	5,850	239,033	.....	.....	.....	.....	.....	.....	.....	.....
New York.....	145,160	83,861	229,021	.....	.....	.....	14	7	21	.....	.....
Ohio.....	369,888	624,336	994,224	.....	.....	.....	8	11	19	.....	.....
Pennsylvania.....	777,780	234,105	1,011,885	.....	.....	.....	54	3	57	.....	.....
South Dakota.....	206,603	62,553	269,156	.....	.....	.....	15	2	17	.....	.....
Tennessee.....	65,603	74,025	139,628	.....	.....	.....	7	3	10	.....	.....
West Virginia.....	227,646	135,038	362,684	.....	.....	.....	15	11	26	.....	.....
Wisconsin.....	206,297	12,628	218,925	.....	.....	.....	26	1	27	.....	.....
Other States ¹	526,234	176,668	702,902	.....	.....	.....	56	6	62	.....	.....
Total.....	2,868,458	1,465,071	4,333,529	.....	.....	.....	203	49	252	.....	.....

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

TABLE 26.—*Accident-frequency rates per million man-hours of employment, by causes and kinds of stone for the years ended Dec. 31, 1937 and 1938*

Cause	Cement rock		Granite		Limestone		Limestone (chief product lime)		Marble		Sandstone		Slate		Trap rock	
	1937	1938	1937	1938	1937	1938	1937	1938	1937	1938	1937	1938	1937	1938	1937	1938
OPEN QUARRY																
1. Falls or slides of rock or overburden.....	1.39	2.05	3.43	4.24	4.85	5.95	7.38	8.49	6.05	3.67	3.92	2.85	11.08	5.06	8.03	8.84
2. Handling materials.....	3.09	3.72	16.25	13.71	17.81	19.37	30.17	27.64	12.64	9.65	22.94	22.78	30.46	32.90	26.18	19.39
3. Hand tools.....	.93	1.86	3.32	4.26	4.33	4.12	4.20	4.33	11.01	11.01	8.67	4.68	1.38	3.16	3.49	2.72
4. Explosives.....	1.69	3.77	9.99	1.75	8.85	9.99	2.29	3.00	1.10	.96	6.90	4.20	2.31	1.27	3.44	1.02
5. Haulage.....	1.69	1.68	2.76	4.44	5.74	7.13	7.83	3.50	3.50	5.63	3.92	7.12	2.84	6.96	3.84	1.36
6. Falls of persons.....	1.69	1.80	6.96	5.23	5.91	6.52	7.13	6.16	3.30	5.03	2.82	3.01	6.00	6.96	16.75	13.95
7. Falling objects (other than 1 and 2).....	.93	.74	2.24	2.74	2.30	2.30	2.04	2.83	1.30	1.20	2.82	3.01	6.00	6.96	3.49	2.04
8. Flying objects.....	.56	.56	8.84	5.23	7.77	10.34	6.87	6.99	3.85	14.67	13.43	7.47	4.15	1.90	8.03	9.86
9. Electricity.....	1.08	.56	3.10	5.11	1.84	3.32	1.38	1.23	5.10	8.25	3.36	1.07	1.38	1.27	8.03	4.42
10. Drilling and channeling (by machine or hand).....	1.08	1.12	6.08	4.74	6.12	4.75	3.57	1.33	2.30	5.06	3.36	6.05	3.23	3.79	6.98	6.12
11. Machinery.....	.15	.44	.50	.50	.80	.21	1.83	1.83	1.65	.46	.56	.71	.63	.63	.35	.35
12. Stepping on nail.....	.31	.37	.88	.50	.76	1.67	1.02	1.50	.55	3.21	.84	.71	3.69	1.27	4.19	1.02
13. Boiler and air-tank explosions.....	1.54	.19	5.08	2.87	4.90	4.49	2.67	6.49	5.50	10.55	8.95	6.41	3.69	1.27	4.19	1.02
14. Burns.....	14.81	15.08	61.89	51.85	65.80	69.11	76.63	77.42	52.24	84.38	80.02	72.25	71.52	62.00	94.24	73.47
15. Other causes.....																
Total, at open quarry.....	8.24	2.97	15.82	11.20	6.22	11.42	14.81	14.81	4.66	7.10	9.64		12.13	31.81	40.12	27.87
UNDERGROUND QUARRY																
1. Fall of rock from roof or wall.....	24.74	15.82	1.37	1.66	1.24	2.86	2.12	0.82	3.55		28.92		4.05	15.91	20.06	
2. Rock while loading at working face or chute.....	3.44	1.98	3.44	3.32	6.62	3.32	1.06	0.82	3.55		28.92		8.09	7.95		
3. Hand tools.....	10.39	1.98	3.44	3.32	6.62	3.32	1.06	0.82	3.55		28.92		8.09	7.95		
4. Explosives.....	.69	4.04	32.19	.83	5.60	2.86	5.29	0.82	3.55		28.92		4.05	7.95	40.12	
5. Haulage.....	7.56	5.93	4.04	3.73	4.98	3.81	6.99	6.99	6.99		28.92		4.05	7.95	20.06	
6. Falling down chute, winze, raise, or stope.....	6.18	2.97	6.18	.62	2.86	3.17	2.33	3.17	2.33		28.92		4.05	7.95	20.06	
7. Run of rock from chute or pocket.....	.69	4.04	32.19	.83	5.60	2.86	5.29	0.82	3.55		28.92		4.05	7.95	40.12	
8. Drilling.....	7.56	5.93	4.04	3.73	4.98	3.81	6.99	6.99	6.99		28.92		4.05	7.95	20.06	
9. Electricity.....	6.18	2.97	6.18	.62	2.86	3.17	2.33	3.17	2.33		28.92		4.05	7.95	20.06	
10. Machinery (other than locomotives or drills).....	.69	4.04	32.19	.83	5.60	2.86	5.29	0.82	3.55		28.92		4.05	7.95	40.12	
11. Mine fires.....																
12. Suffocation from natural gases.....																
13. Inrush of water.....				4.1	1.24	4.23	4.23	4.23	6.99	3.55	9.64		8.09	7.95		
14. Stepping on nail.....	16.49	11.86	32.19	4.56	5.60	1.06	25.62	10.66	19.28		28.92		8.09	7.95		
15. Handling materials (other than rock).....	86.57	52.40	64.39	83.00	46.04	44.16	49.51	53.96	65.23	24.87	106.05		60.68	87.47	120.37	27.87
16. Other causes.....																
Total, at underground quarry.....	86.57	52.40	64.39	83.00	46.04	44.16	49.51	53.96	65.23	24.87	106.05		60.68	87.47	120.37	27.87

TABLE 26.—Accident-frequency rates per million man-hours of employment, by causes and kinds of stone for the years ended Dec. 31, 1937 and 1938—Continued

Cause	Cement rock		Granite		Limestone		Limestone (chief product line)		Marble		Sandstone		Slate		Trap rock	
	1937	1938	1937	1938	1937	1938	1937	1938	1937	1938	1937	1938	1937	1938	1937	1938
SHAFT OR SLOPE																
17. Falling down shaft or slope.....																
18. Objects falling down shaft or slope.....																
19. Breaking of cables.....		1.98														
20. Overwinding.....																
21. Cages, skip, or bucket.....		.69			.41								4.05			
22. Other causes.....																
Total, in shaft or slope.....	.69	4.94			.41								4.05			
Total, underground (including shaft).....	87.26	57.35	64.39	83.00	46.45	44.16	49.51	53.96	65.23	24.87	106.05		64.73	87.47	120.37	27.87
OUTSIDE WORKS																
1. Haulage.....	.48		1.14	.83	3.49	3.30	3.24	3.05	8.00	3.66	3.27	1.37	4.96	3.11	1.28	2.05
2. Machinery.....	1.27		3.28	5.00	5.75	7.85	4.49	4.67	4.11	4.15	13.09	4.78	4.13	6.61	7.69	8.20
3. Hand tools.....	.46		3.71	3.17	2.33	3.85	2.50	3.14	5.40	3.17	13.64	1.37	2.48	9.33	3.21	3.42
4. Stepping on nail.....	.14		.05	.29	.48	.31	.52	.54	3.86	.98	1.64	1.37	2.48	9.33	3.21	3.42
5. Electricity.....	.41		.17	.29	.48	.31	.52	.54	3.86	.98	1.64	1.37	2.48	9.33	3.21	3.42
6. Falls of persons.....	1.60		2.14	2.00	3.97	3.77	3.02	4.13	3.68	3.17	2.73	3.41	5.51	3.50	7.66	5.46
7. Falling objects (rocks, timbers, etc.).....	.95		6.62	2.86	3.42	4.55	3.46	2.60	6.49	6.35	2.73	2.05	1.38	1.95	1.28	3.42
8. Flying objects.....	.87		17.28	8.84	4.58	5.49	3.90	3.68	6.49	7.32	17.46	3.41	3.30	2.72	5.77	4.10
9. Handling materials.....	1.06		7.57	5.34	5.68	4.39	7.73	5.75	9.94	13.18	5.46	8.19	23.43	20.22	2.57	4.10
10. Burns.....	.52		.36	.33	1.50	2.04	5.08	6.01	.65	.73	.54	1.37	2.48	3.39	2.57	2.05
11. Other causes.....	1.79		1.59	3.00	4.24	4.86	8.03	5.03	3.24	4.15	3.27	6.14	1.93	3.89	8.34	9.57
Total, at outside works.....	9.55	8.19	43.84	30.84	35.93	40.71	42.34	38.96	49.07	46.87	64.38	33.45	47.69	52.50	40.39	42.37
Grand total.....	12.17	9.98	54.04	42.93	53.92	57.12	54.65	52.51	50.92	58.39	75.31	58.15	56.93	57.04	75.76	62.85

DIMENSION-STONE AND NONDIMENSION-STONE QUARRIES

In 1938, as in previous years, reports from operating companies were classified according to the general use to which the material was to be put. Special data were compiled for quarries producing stone for building or monumental use or for any purpose requiring shaping of the stone. A second class covered reports from quarries whose output was crushed or powdered for use in road building, as flux, for agricultural purposes, or in the manufacture of cement or lime, or whose rock was to be used in unshaped or irregular form. A third group covered reports from quarries which did not indicate clearly the use for which the stone was produced.

Employment and accident data are given for the three groups of quarries in tables 27 to 32, inclusive. Four to five times as many employees and man-hours of work were performed at nondimension-stone as at dimension-stone properties. Cement rock and limestone for making cement were the principal kinds of stone in the nondimension-stone group. Granite was the principal stone in the dimension-stone group. The third group covered quarries whose reports did not clearly indicate whether their output was to be used in dimension or nondimension form. This group was small, covering only 1,820 employees out of a total of 77,497 in the three groups combined.

The leading causes of accidents for both dimension-stone and nondimension-stone quarries were handling materials, flying objects, and falls of persons. However, nondimension-stone quarries had a more favorable accident-frequency rate—35.10 per million man-hours of exposure to risk—than dimension-stone quarries, whose rate was 50.26. This favorable showing for nondimension stone must be credited largely to the cement industry, without whose record the rate for the group was 55.73.

Limestone quarries whose output was to be used as dimension stone had an accident-frequency rate of 50.64, which compares with 57.49 for quarries producing the same kind of stone to be used in crushed or nondimension form. Sandstone quarries had a dimension-stone rate of 36.64 compared with 67.45 for nondimension stone. The rate for granite quarries was nearly the same for both kinds of stone—44.85 for dimension stone and 43.57 for nondimension stone.

TABLE 27.—*Dimension-stone and nondimension-stone quarries: Men employed and man-days, by kind of quarry, during the year ended Dec. 31, 1938*

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.....	2,619	2,551	5,170	511,047	534,494	1,045,541	195	210	202
Limestone.....	912	1,507	2,419	170,779	313,505	484,284	187	208	200
Marble.....	1,102	1,996	3,098	249,161	487,237	736,398	226	244	238
Sandstone.....	650	435	1,085	121,825	100,264	222,089	187	230	205
Slate.....	879	1,250	2,129	167,965	237,188	405,153	191	190	190
Trap rock.....	11	-----	11	1,930	-----	1,930	175	-----	175
Total.....	6,173	7,739	13,912	1,222,707	1,672,688	2,895,395	198	216	208
Nondimension stone:									
Cement rock.....	3,874	21,646	25,520	843,150	5,672,710	6,515,860	218	262	255
Granite.....	1,747	641	2,388	389,921	152,357	542,278	223	238	227
Limestone.....	13,082	6,365	19,447	2,358,246	1,243,177	3,601,423	180	195	185
Limestone (chief product, lime).....	3,667	5,486	9,153	915,132	1,460,394	2,375,526	250	266	260
Marble.....	67	67	134	9,089	15,297	24,386	136	228	182
Sandstone.....	1,299	424	1,723	209,144	75,172	284,316	161	177	165
Slate.....	113	233	346	21,135	47,882	69,017	187	206	199
Trap rock.....	1,979	1,075	3,054	360,305	181,441	541,746	182	169	177
Total.....	25,828	35,937	61,765	5,106,122	8,848,430	13,954,552	198	246	226
All other and not stated:									
Granite.....	562	275	837	144,619	66,377	210,996	257	241	252
Limestone.....	422	64	486	74,879	13,889	88,768	177	217	183
Marble.....	136	46	182	33,007	6,194	39,201	243	135	215
Sandstone.....	96	3	99	21,328	786	22,114	222	262	223
Slate.....	51	89	140	12,996	23,553	36,549	255	265	261
Trap rock.....	76	-----	76	8,253	-----	8,253	109	-----	109
Total.....	1,343	477	1,820	295,082	110,799	405,881	220	232	223
Grand total.....	33,344	44,153	77,497	6,623,911	10,631,917	17,255,828	199	241	223

TABLE 28.—Dimension-stone and nondimension-stone quarries: Accident rates per million man-hours during the year ended Dec. 31, 1938

Kind of quarry	Man-hours of employment				Killed				Injured					
	Open quarries		Under-ground quarries		At quarry		At outside works		At quarry		At outside works		Total	
	Number	Total	Number	Total	Number	Per million man-hours	Number	Per million man-hours	Number	Per million man-hours	Number	Per million man-hours	Number	Per million man-hours
Dimension stone:														
Granite	3,945,651	8,249,268	24,096	4,276,521	7	1.76	2	0.47	220	55.38	141	32.97	361	43.76
Limestone	1,360,609	3,870,623		2,510,014			2	.80	111	81.58	83	33.07	194	50.12
Marble	1,827,001	6,017,852	270,263	3,920,588					177	84.40	181	46.17	358	59.49
Sandstone	961,386	1,773,863		812,477					45	46.81	20	24.62	65	36.64
Slate	1,342,447	3,373,174	73,336	1,957,391	1	.71			83	58.62	94	48.02	177	52.47
Trap rock	15,442	15,442							4	259.03			4	259.03
Total	9,455,536	23,300,222	367,695	13,476,991	8	.81	4	.30	640	65.15	519	38.51	1,159	49.74
Nondimension stone:														
Cement rock	5,369,929	48,507,624	1,011,403	42,126,292	8	1.25	6	.14	131	20.53	339	8.05	470	9.69
Granite	3,216,138	4,521,080		1,304,942	16	4.97			150	46.64	31	23.76	181	40.03
Limestone	17,231,313	28,927,986	1,572,740	10,123,933	16	.85	4	.40	1,226	65.20	417	41.19	1,643	56.80
Limestone (chief product, lime)	6,006,198	18,091,502	945,160	11,140,144	7	1.01	7	.63	7,309	73.22	427	38.33	936	51.74
Marble	72,406	135,177		122,771	1	13.81			2	27.62	10	81.45	12	61.48
Sandstone	1,081,986	2,386,923	58,631	646,306					132	73.84	23	44.87	161	67.45
Slate	152,192	424,036	29,436	824,036					11	60.36	23	54.24	34	36.13
Trap rock	2,858,634	4,357,780	35,880	1,463,276	4	1.38	1	.68	209	72.21	61	41.69	270	61.96
Total	30,588,796	107,583,766	3,653,270	67,351,700	52	1.29	18	.27	2,370	58.89	1,337	19.85	3,707	34.45
All other and not stated:														
Granite	857,784	1,274,645		416,911					25	29.15	11	26.98	36	28.24
Limestone	560,097	1,714,330	35,200	113,042					42	69.85	13	113.00	55	76.00
Marble	281,119	345,533	11,245	53,198					11	37.62	1	18.81	12	34.72
Sandstone	166,605	172,743		6,288					26	156.20			26	156.51
Slate	86,009	298,829	22,960	189,960					14	128.59	18	94.76	32	107.08
Trap rock	60,094	66,094												
Total	2,023,348	2,872,123	69,405	779,370					118	56.39	43	55.17	161	56.06
Grand total	48,067,680	133,766,111	4,090,370	81,608,061	60	1.15	22	.27	3,128	59.97	1,899	23.27	5,027	37.58

Utah.....	1,982	3,633,197	3	140	83	45,887	335,812	27	80.40	11	1,910	15,280	5	327.23
Vermont.....	364	48,651	11	25.22	180	44,662	398,092	51	128.11	11	2,981	26,829	3	22.89
Virginia.....	30	5,839	6	128.42	1,124	220,640	1,675,005	4	2.39	94	16,092	131,045	3	22.89
West Virginia.....	90	12,156	17	174.77	1,424	298,397	2,299,178	61	26.53	51	4,594	36,754	18	244.53
Wisconsin.....	471	91,138	62	84.71	729	137,983	1,106,514	84	75.91	35	9,202	73,612	18	244.53
Wyoming.....	6	1,554	240	60.172	481	363	62.32	30	26.74	30	6,834	61,503	11	178.85
Other States ¹			256	74,950		635,746		17						
Total.....	13,912	2,895,395,233,300,222	12	1,159	.52	49.74	61,765,13,954,552,107,593,766	70	3.707	.65	1,820,405,881	2,872,123	161	56.06

¹ Includes Delaware, Louisiana, Mississippi, and Nevada.

TABLE 31.—Dimension-stone and nondimension-stone quarries: Men employed, man-days, man-hours, man-hours, number killed and injured, and rates per million man-hours, by States, inside the quarries, during the year ended Dec. 31, 1938

State	Dimension stone						Nondimension stone						All other and not stated				
	Men employed	Man-days	Man-hours	Killed	Injured	Rate	Men employed	Man-days	Man-hours	Killed	Injured	Rate	Man-days	Man-hours	Killed	Injured	Rate
Alabama.....	216	41,413	335,112				691	162,192	1,230,359	2	33	1.63					
Arizona.....	16	2,484	19,873		70	208.89	88	23,535	172,952	11	37	5.71					
Arkansas.....	7	650	5,200				86	24,130	175,239	1	137	2.51					1.99
California.....	83	12,762	100,377		2	19.92	1,055	251,555	988,268	5	13	64.85	384,100,638	503,192			
Colorado.....	158	35,143	252,454		3	3.96	1,588	27,392	200,450	25	25	55.87	3	900	7,200		
Connecticut.....	67	13,819	110,550	1	5	9.05	45.23	53,779	447,490	47	47	66.46	2	300	2,400		
Florida.....	2	614	4,912		43	62.19	450	60,689	707,221	37	37	70.56	37	8,658	69,264	13	187.69
Georgia.....	388	86,328	691,448				266	65,004	524,343	19	19	233.15					
I Idaho.....	1	45	360				114	11,812	81,491	3	92	1.12	210	30,085	240,680	4	16.62
Illinois.....	2	120	960		39	51.51	1,951	419,230	2,672,773	3	61	1.59	64	14,706	106,173	6	56.51
Indiana.....	519	94,636	757,096				758	135,256	673,990	1	26	3.79	9	1,800	14,400	1	69.44
Iowa.....	10	907	7,257		1	100.73	463	90,850	687,909	2	124	2.91					
Kansas.....	9	571	5,243				487	158,917	1,429,155	6	6	44.21					
Kentucky.....	407	45,209	359,779	1	26	2.78	87	17,956	135,714	44	46	62.53	8	1,950	14,865	3	591
Maine.....	18	659	155,772		13	89.87	401	86,238	735,693	46	46	1.62	8	581	4,728		
Maryland.....	324	59,370	473,046		14	27.48	355	75,038	616,793	1	55	68					
Massachusetts.....	81	18,581	145,772		13	27.48	997	183,363	1,468,157	1	31	174.32	8	2,052	17,077	7	106.48
Michigan.....	260	57,686	455,741	1	13	2.19	28,52	22,116	177,837	3	165	1.50	45	8,160	65,740		
Minnesota.....	118	27,778	222,224		13	58.50	1,632	271,403	1,993,579	3	39	5.45	5	79	632		
Missouri.....	20	3,635	29,080		7	240.72	517	114,778	918,235	5							

TABLE 31.—Dimension-stone and nondimension-stone quarries: Men employed, man-days, man-hours, number killed and injured, and rates per million man-hours, by States, inst. 1; the quarries, during the year ended Dec. 31, 1938—Continued

State	Dimension stone					Nondimension stone					All other and not stated								
	Men employed	Man-days	Man-hours	Killed	Injured	Rate		Man-days	Man-hours	Killed	Injured	Rate		Man-days	Man-hours	Killed	Injured	Rate	
						Killed	Injured					Killed	Injured					Killed	Injured
Nebreska	131	16,340	130,253	1	15	7.68	115.16	75	17,207	120,011	2	16.67							
New Hampshire	5	925	7,400					435	2,010	12,060	36	48.02							
New Jersey								78	94,557	749,693	9	134.60							
New York	102	14,843	119,935	3	3	25.01	25.01	1,656	316,871	2,593,623	5	1.93	24	5,369	38,783	1	25.78		
North Carolina	129	27,694	221,552	3	8	13.54	13.54	1,400	99,118	812,459	5	37.615	32	6,308	63,083	6	95.11		
Ohio	258	46,120	368,688	4	4	21.70	21.70	1,783	361,202	2,843,353	1	103.32	18	3,816	30,768	2	65.00		
Oklahoma	28	7,682	61,456	2	2	65.09	65.09	259	53,657	425,181	3	32.1	70	18,480	147,840	25	212.87		
Oregon	5	616	4,930	1	64	405.68	405.68	209	24,093	179,262	3	17.49	54	15,200	121,609	15	123.35		
Pennsylvania	536	108,118	884,949	1	1	72.32	72.32	4,216	758,572	6,107,533	3	9	207.42						
Rhode Island	44	10,000	79,996	4	4	50.00	50.00	34	5,242	43,390	3	85	5.21						
South Carolina	4	656	5,251					274	69,396	575,523	3	15	147.69						
South Dakota	54	13,936	111,488	188	9	80.73	80.73	188	27,880	241,611	3	93	2.59	115	23,540	265,360	11	41.45	
Tennessee	621	147,511	1,288,001	133	133	103.26	103.26	614	145,277	1,158,805	2	36	2.70						
Texas	60	15,153	118,449	1	1	8.44	8.44	406	92,101	740,952	2	12	104.28						
Utah								78	14,912	115,075	21	14.28	6	360	2,880				
Vermont	1,036	228,887	1,757,459	3	83	1.71	1.71	62	14,302	125,556	21	167.23	11	2,981	26,829	3	31.32		
Virginia	132	17,317	154,132	6	6	37.93	37.93	3,151	41,458	2,614,987	4	58	67.69	67	11,814	95,779	3		
Washington	11	1,246	9,973	2	2	200.54	200.54	568	95,510	709,730	4	27	5.64	51	4,594	36,754			
West Virginia	69	9,142	73,156	14	14	191.37	191.37	646	132,717	1,037,049	4	58	26.04	30	7,887	63,096	16	253.58	
Wisconsin	254	53,138	427,248	42	42	98.30	98.30	438	76,443	621,162	13	109.47	13	95.18					
Wyoming	6	1,554	12,432					101	17,076	136,587	14	88.21	13	3,356	30,200	7	231.79		
Other States ¹								84	20,165	158,667	14	14	1.29						
Total	6,173	1,222,707	9,823,231	8	640	.81	65.15	25,828	5,106,122	40,242,065	52	2,370	58.89	1,343,293	882,2,032,753	118	56.39		

¹ Includes Delaware, Louisiana, Mississippi, and Nevada.

TABLE 32.—Dimension-stone and nondimension-stone quarries. Nonfatal-injury rates, by causes, compared on a per million man-hour basis for the years ended, Dec. 31, 1936 to 1938

Cause of accident	Dimension stone			Nondimension stone		
	1936	1937	1938	1936	1937	1938
OPEN QUARRY						
1. Falls or slides of rock or overburden	1.98	4.24	2.33	6.15	4.92	5.90
2. Handling materials	17.36	17.85	17.98	18.78	18.73	17.27
3. Hand tools	4.72	6.01	5.39	3.61	3.36	3.75
4. Explosives	.22	.35	.53	1.27	1.05	1.23
5. Haulage	.99	1.50	1.59	4.68	5.32	4.24
6. Falls of persons	4.94	5.48	3.49	4.77	6.33	6.15
7. Falling objects (other than 1 and 2)	3.52	3.18	3.49	2.36	2.56	1.72
8. Flying objects	8.13	9.54	9.52	6.63	6.53	7.24
9. Electricity	.22	-----	.10	.23	.24	.38
10. Drilling and channeling (by machine or hand)	2.53	4.51	4.23	2.79	2.54	3.28
11. Machinery	4.18	5.92	5.82	4.61	4.61	3.58
12. Stepping on nail	.44	.71	.63	.18	.49	.27
13. Boiler and air-tank explosions	-----	-----	.10	.04	-----	-----
14. Burns	.22	.53	1.59	.73	.82	1.15
15. Other causes	7.14	7.60	5.18	3.50	3.59	3.69
Total, at open quarry	56.59	67.42	66.10	60.33	61.09	59.85
UNDERGROUND QUARRY						
1. Fall of rock from roof or wall	8.81	3.27	5.44	6.00	10.19	7.66
2. Rock while loading at working face or chute	2.20	3.27	5.44	12.00	19.40	16.15
3. Hand tools	6.60	8.18	8.16	2.14	1.76	1.37
4. Explosives	2.20	3.27	2.72	1.07	1.57	.82
5. Haulage	-----	8.18	-----	6.43	4.90	4.10
6. Falling down chute, winze, raise, or slope	-----	1.64	-----	.43	1.37	-----
7. Run of rock, from chute or pocket	-----	-----	-----	4.28	.98	1.92
8. Drilling	11.01	4.91	8.16	4.28	4.51	3.83
9. Electricity	-----	-----	-----	-----	-----	-----
10. Machinery (other than locomotives or drills)	-----	1.64	-----	1.71	2.74	1.92
11. Mine fires	-----	-----	-----	-----	-----	-----
12. Suffocation from natural gases	-----	-----	-----	-----	.20	-----
13. Inrush of water	-----	-----	-----	-----	-----	-----
14. Stepping on nail	-----	-----	-----	-----	.20	1.64
15. Handling materials (other than rock)	6.60	4.91	2.72	6.64	3.72	2.19
16. Other causes	30.81	22.91	8.16	9.00	7.25	6.30
Total, at underground quarry	68.23	62.19	40.80	53.99	58.79	47.90
SHAFT OR SLOPE						
17. Falling down shaft or slope	-----	-----	-----	.21	-----	-----
18. Objects falling down shaft or slope	-----	-----	-----	.21	-----	.27
19. Breaking of cables	-----	-----	-----	-----	-----	.55
20. Overwinding	-----	-----	-----	-----	-----	-----
21. Cage, skip, or bucket	-----	1.63	-----	-----	.19	-----
22. Other causes	-----	-----	-----	.86	.19	.55
Total, in shaft or slope	-----	1.63	-----	1.28	.39	1.37
Total underground (including shaft)	68.23	63.82	40.80	55.27	59.18	49.27
OUTSIDE WORKS						
1. Haulage	1.43	3.40	1.85	1.31	1.57	1.44
2. Machinery	4.29	4.66	4.90	3.37	2.79	3.32
3. Hand tools	3.27	4.53	3.64	1.69	1.34	1.68
4. Stepping on nail	.34	.44	.37	.32	.30	.21
5. Electricity	.21	.13	-----	.34	.38	.24
6. Falls of persons	2.86	3.53	2.45	2.67	2.29	2.15
7. Falling objects (rocks, timbers, etc.)	3.14	4.34	3.93	1.40	1.71	1.62
8. Flying objects	6.07	12.03	7.94	2.40	2.20	1.87
9. Handling materials	9.61	10.70	9.57	3.45	3.35	2.70
10. Burns	.27	.25	.37	2.06	1.57	1.62
11. Other causes	6.95	4.41	3.49	3.26	3.26	3.00
Total, at outside works	38.44	48.42	38.51	22.27	20.76	19.85
Grand total	45.18	56.49	49.74	37.53	36.38	34.45
MAN-HOURS OF EMPLOYMENT						
Open quarries	9,100,679	11,317,886	9,455,536	44,039,132	44,898,390	36,588,796
Underground quarries	454,370	611,058	367,695	4,667,630	5,102,803	3,653,270
At outside works	14,673,191	15,881,299	13,467,991	71,216,374	78,509,374	67,351,700
Total	24,228,240	27,810,243	23,300,222	119,923,136	128,510,567	107,593,766

NONFATAL-INJURY RATES FROM MAIN CAUSES OF ACCIDENTS INSIDE OPEN-QUARRYING OPERATIONS IN PRINCIPAL QUARRY- ING STATES

Although 5,109 men were injured by accidents in the quarrying and related industries in the United States in 1938, reports from the operating companies showed that about 46 percent of the injuries were chargeable to seven main causes of accidents associated with open quarrying. Moreover, although quarrying was done in 47 States, the 10 States with the largest number of employees had 60 percent of the total number of workers and 53 percent of the total number of accidents.

The results of a special examination of the seven leading causes of accidents in open quarrying in the 10 leading quarrying States are shown in table 33 in the form of accident-frequency rates per million man-hours of exposure to hazard. The accident rates given in the table cover nonfatal injuries, as the number of such injuries from any given cause is normally much larger than the number of fatal injuries, hence these rates are more reliable indicators of the accident hazards to which quarry workers are exposed.

In 1938 the 10 States having the largest number of employees in quarrying and related work were Pennsylvania, Ohio, New York, Illinois, Indiana, California, Missouri, Michigan, Virginia, and Tennessee.

The chief cause of accidents—the cause comprising the largest number of injuries—in the quarrying industry in the United States in 1938 was handling materials. For each million man-hours worked in open quarries the accident-frequency rate for accidents of this type was 17.85. Missouri had a much higher rate (33.95) for the same class of accidents, whereas the lowest rate among the 10 leading States, that for New York, was only 2.99 per million man-hours worked. Ranking second as a cause of injuries to quarry workers in 1938 was flying objects. Accidents of this class had a frequency rate of 7.64 for the United States compared with a maximum of 19.65 for Missouri and a minimum of 1.12 for Indiana among the 10 leading quarry States. Next in importance as a cause of nonfatal accidents was falls of persons, for which the average rate for the whole industry was 6.26, the maximum among the leading States being 10.22 for Michigan and the minimum being 1.38 for California. Falls or slides of rock or overburden ranked fourth as a cause of injuries with a rate of 5.04 per million man-hours of exposure. Compared with this average rate, Virginia reported a rate of 10.22 and Michigan a rate of zero. Accidents caused by machinery and those caused by hand tools had rates of 3.95 each. Individual State rates for machinery accidents ranged from 8.92 for Indiana to 1.67 for Ohio. Rates for hand-tool accidents ranged from a maximum of 11.91 for Missouri to a minimum of 0.72 for Illinois. Ranking seventh among causes of quarry accidents was haulage equipment with a rate of 3.72 for the industry as a whole, the maximum being 4.14 for California and the minimum being 1.36 for Michigan among the 10 States having the largest number of employees in the quarrying industry.

Table 33 gives the accident-frequency rates for nonfatal injuries from each of the seven main causes of accidents in each of the 10 lead-

ing States. A comparison of the rates in this table with corresponding rates published last year for 1937 reveals the classes of accidents in which safety progress was or was not made by the quarrying industry in individual States in 1938.

TABLE 33.—*Nonfatal-injury rates per million man-hours of employment inside open quarries, during the year ended Dec. 31, 1938, in principal quarrying States, by chief causes of accidents*

Cause	United States	Pennsylvania	Illinois	Ohio	New York	Virginia	Missouri	California	Indiana	Tennessee	Michigan
Handling materials.....	17.85	21.41	5.80	8.66	2.99	20.79	33.95	6.89	10.60	17.54	8.85
Flying objects.....	7.64	5.93	2.90	6.66	3.37	7.05	19.65	2.30	1.12	15.91	4.77
Falls of persons.....	6.26	7.57	5.07	4.99	5.24	3.88	5.36	1.38	3.35	9.79	10.22
Falls or slides of rock or overburden.....	5.04	4.45	2.90	1.33	2.99	10.22	8.34	5.05	2.79	5.30	-----
Machinery.....	3.95	4.61	3.26	1.67	5.99	3.17	1.79	3.68	8.92	4.89	5.45
Hand tools.....	3.95	3.29	.72	1.67	2.99	1.76	11.91	2.76	1.67	11.83	2.72
Haulage.....	3.72	3.46	3.26	3.00	3.75	2.82	3.57	4.14	3.90	3.26	1.36
Total, chief causes.....	48.41	50.72	23.91	27.98	27.33	49.69	84.57	26.20	32.35	68.52	33.38
All other causes.....	12.52	10.04	9.42	8.66	10.85	14.80	14.29	11.03	20.08	21.21	4.08
Total, open quarry.....	60.93	60.76	33.33	36.64	38.18	64.49	98.86	37.23	52.44	89.73	37.46

COMPARATIVE SEVERITY OF INJURIES

Accidents caused by the hazards to which industrial workers are exposed generally are classified into four main groups: Deaths, permanent total disabilities, permanent partial disabilities, and temporary disabling or lost-time injuries. Two other classes are added by some agencies, especially by a few large operating companies that keep a full record of safety conditions surrounding their employees; these two classes cover injuries from which the employee recovers quickly and returns to work on the day following the injury and injuries that only partly disable an employee yet are not serious enough to prevent him from doing some work at the plant. Accident reports furnished by operating companies to the Bureau of Mines do not cover the last two classes of injuries.

Reports received during the past 5 years (1934-38) show that 25,529 lost-time or disabling injuries, both fatal and nonfatal, were caused by accidents at quarries and related plants in the United States. A classification of these accidents shows that, of every 1,000 accidents reported, 956 were temporary from which the injured employee recovered and was able to resume work without having lost the use of any part of his body. A smaller number of injuries, averaging 29 out of each 1,000, were of a more serious type known as permanent partial disability, as they caused the dismemberment or the loss of use of some part of the body. One out of each 1,000 injuries disabled the employee completely and permanently. Such injuries were therefore classified as permanent total disability, as they prevented the employees from engaging in any gainful occupation. In 14 out of each 1,000 accidents the injured employees lost their lives.

This classification of accidents during the past 5 years is probably a fair representation of the relative severity of injuries to men em-

ployed in the quarrying industry. The distribution did not differ notably from that covering a previous 5-year period (1929-33), when the reports indicated that 955 out of each 1,000 injuries were temporary, 31 were permanent partial disabilities, 1 was a permanent total disability, and 13 caused the death of the injured workers. (See table 34.)

RATIO OF INJURIES TO FATALITIES

Accidents at quarries and related plants in 1938 occurred at the rate of 61 nonfatal injuries to 1 fatality. This ratio was notably different from that for 1937 when the reports from operating companies revealed 82 injuries per fatality, but it was almost identical with the ratio for 1936—63 injuries per fatality.

Among employees at both open and underground quarries the mortality ratio was 52 to 1. For employees at plants outside the quarries, such as crushing and finishing plants, cement mills, and limekilns, the ratio was 86 to 1.

Falls or slides of rock or overburden, one of the chief hazards to which quarry workers are exposed, had a ratio of 13 injuries to each fatality.

Table 11 shows the number of deaths and injuries from each of the important causes of accidents in the quarrying industry in 1938, and from these figures the mortality ratio for each cause may be determined.

TABLE 34.—All quarries: Number of fatalities and injuries, and fatality and injury rates, per million man-hours of employment, classified by severity of injury, 1929-38

NUMBER OF QUARRY ACCIDENTS

Severity of injury	Total, 1929-33	1934	1935	1936	1937	1938	Total, 1934-38
Fatal.....	383	60	51	91	77	82	361
Permanent total ¹	40	3	7	8	4	5	27
Permanent partial ²	951	114	122	171	173	153	733
Temporary ³	28,874	3,807	4,023	5,538	6,171	4,869	24,408
Total.....	30,248	3,984	4,203	5,808	6,425	5,109	25,529

RATES PER MILLION MAN-HOURS OF EMPLOYMENT ⁴

Fatal.....	0.537	0.630	0.464	0.619	0.487	0.613	0.560
Permanent total ¹.....	.056	.031	.063	.054	.025	.037	.042
Permanent partial ²	1.333	1.197	1.109	1.163	1.093	1.144	1.137
Temporary ³	40.461	39.965	36.562	37.657	38.933	36.399	37.876
Total.....	42.387	41.823	38.198	39.493	40.588	38.194	39.615
Number of employees per year.....	70,837	64,331	73,005	80,022	84,094	77,497	75,790

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 1929-33 computed on basis of man-hours worked, the number of man-hours for 1929 and 1930 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 predominantly an aboveground method of operation, the Bureau of Mines canvass of the quarrying industry in 1938, covering 2,136 quarries, showed that 102 properties were underground quarries or mines. Eighty-one of these were mines that produced limestone or cement rock; the other mines produced marble, sandstone, granite, slate, or trap rock. The largest number of employees underground was reported for Pennsylvania, where 22 mines were active in 1938. Missouri ranked first in number of underground quarries, with 24 plants, and second in number of men employed underground. West Virginia ranked third in number of workers and California fourth.

The combined accident-frequency rate for all underground quarries that were active in 1938 was 49.14 per million man-hours of employment underground. This rate showed an improvement over the 1937 rate of 61.27. The total number of underground employees at all operations was only 2,604 men, whose aggregate working time was approximately 4 million man-hours—an average of 198 workdays or 1,571 man-hours per underground worker. Two fatalities and 199 nonfatal lost-time injuries were caused by accidents during the year. The chief causes of the accidents, as stated elsewhere in this bulletin, were loading rock at the working face or chute and falls of rock from the roof or wall. (See tables 9 and 35.)

TABLE 35.—*Accident data for underground quarries in the United States in 1938*
[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	81	2,278	448,564	3,564,503	197	1,565	2	178	50.50
Marble.....	5	154	35,263	281,508	229	1,828	-----	7	24.87
Sandstone and granite.....	5	56	10,298	82,727	184	1,477	-----	2	24.18
Slate and trap rock.....	11	116	20,175	161,032	174	1,393	-----	12	74.24
Total.....	102	2,604	514,300	4,090,370	198	1,571	2	199	49.14

UNDERGROUND QUARRIES, BY STATES

California.....	7	197	53,132	416,253	270	2,113	-----	59	141.74
Illinois.....	4	76	19,290	154,419	254	2,032	-----	4	25.90
Kansas.....	3	60	11,270	90,157	188	1,503	-----	6	66.55
Kentucky.....	7	89	13,565	122,466	152	1,376	-----	11	89.82
Missouri.....	24	455	77,903	602,446	171	1,324	1	19	33.20
Ohio.....	6	142	31,485	240,561	222	1,694	-----	3	12.47
Pennsylvania.....	22	803	130,119	1,041,309	162	1,297	-----	28	26.89
Tennessee.....	5	128	32,512	260,320	254	2,034	1	17	69.15
Vermont.....	3	127	31,610	253,799	249	1,998	-----	8	31.52
West Virginia.....	4	209	50,611	405,422	242	1,940	-----	14	34.53
Other States ²	17	318	62,803	503,218	197	1,582	-----	30	59.62
Total.....	102	2,604	514,300	4,090,370	198	1,571	2	199	49.14

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

² Includes Alabama, Colorado, Georgia, Indiana, Iowa, Maine, Maryland, Nevada, New York, Rhode Island, Virginia, and Wyoming.

TABLE 36.—*Accident rates, men employed, etc., at cement mills (including crushers and miscellaneous work) during the year ended Dec. 31, 1938*

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.....	855	213, 119	249	1, 540, 906	2	3	4	7	1.30	4.54	
California.....	1, 386	450, 679	325	3, 447, 469	1	6	100	106	.29	30.75	
Illinois.....	1, 073	266, 138	248	1, 707, 615	-----	-----	3	3	-----	1.76	
Indiana.....	994	250, 186	252	1, 811, 593	-----	-----	1	1	-----	.55	
Iowa.....	1, 031	284, 765	276	2, 106, 788	-----	-----	8	8	-----	3.80	
Kansas.....	759	199, 902	263	1, 551, 410	-----	-----	3	3	-----	1.93	
Michigan.....	1, 365	386, 260	283	3, 083, 284	1	1	14	15	.32	4.86	
Missouri.....	865	264, 153	305	1, 801, 477	-----	-----	1	2	-----	1.67	
New York.....	1, 344	311, 455	232	2, 483, 295	-----	-----	1	8	-----	3.62	
Ohio.....	1, 230	312, 623	254	2, 411, 372	1	4	11	15	.41	6.22	
Pennsylvania.....	4, 537	1, 146, 153	253	8, 242, 649	1	3	32	35	.12	4.25	
Tennessee.....	575	135, 722	236	1, 063, 625	-----	-----	3	6	-----	8.46	
Texas.....	1, 254	337, 401	269	2, 583, 851	-----	-----	3	19	-----	8.51	
Virginia.....	333	96, 003	238	636, 412	-----	-----	1	3	-----	6.29	
Washington.....	415	95, 916	231	731, 679	-----	-----	6	6	-----	8.20	
West Virginia.....	283	64, 935	229	496, 213	-----	-----	1	8	-----	18.14	
Other States.....	3, 347	857, 300	256	6, 426, 654	-----	-----	2	82	-----	13.07	
Total.....	21, 646	5, 672, 710	262	42, 126, 292	6	30	309	339	.14	8.05	

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.....	-----	4	-----	-----	1	1	-----	-----	-----	-----	-----	6
Permanent total.....	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Permanent partial.....	1	21	1	-----	-----	2	4	1	-----	-----	-----	30
Temporary.....	18	43	19	2	6	45	22	26	46	15	67	309
Total nonfatal.....	19	64	20	2	6	47	26	27	46	15	67	339

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

Ninety-seven percent of all quarries that were active in the United States in 1938 were operated without an accident resulting fatally to an employee. Of the 2,136 active plants, 2,070 were operated without a fatality. The 82 lives lost during the year were the result of accidents at 66 plants. About 91 percent of all employees in the industry worked at plants that did not have a fatality. The plants that were free of fatal accidents included many large operations but, on the whole, were smaller than the plants at which the fatal accidents occurred, averaging 34 employees per plant compared with 108 employees per plant where the 82 fatalities occurred.

The record for 1937 also showed 91 percent of employees at accident-free plants and that for 1936 showed 88 percent.

Thus the entire fatality toll of the quarrying industry during the past 3 years can be credited to a relatively small number of plants that employed from 9 to 12 percent of the total number of employees at all plants.

The records of 91 percent of all quarry workers included at plants that had no fatal accidents in 1938 and 1937 compare favorably with records for bituminous-coal mines for 1937 (latest year available) which showed only 56 percent and those for metal mines for 1937 which showed 70 percent of all employees working at mines that did not have a fatality.

Tables 37 to 39 show the proportion of the quarrying industry in each State and in the United States as a whole that was free of fatal accidents in 1938.

TABLE 37.—Comparative fatal and nonfatal accident data for the quarrying and related industries in the United States during the year ended Dec. 31, 1938

	Plants that had no fatal accidents	Plants that had fatal accidents	All plants
Number of plants.....	2,070	66	2,136
Number of employees.....	70,351	7,146	77,497
Proportion of total employees..... percent.....	90.8	9.2	100
Number of employees per plant.....	34	108	36
Man-days of employment.....	15,448,239	1,807,589	17,255,828
Average worked per man..... days.....	220	253	223
Man-hours of employment.....	120,259,707	13,506,404	133,766,111
Average work per man..... hours.....	1,709	1,890	1,726
Number of men killed.....	4,444	82	82
Number of men injured.....	4,444	583	5,027
Death rate per million man-hours.....	.....	6.07	.61
Injury rate per million man-hours.....	36.95	43.16	37.58

TABLE 38.—Quarries and related plants: Number of men employed in 1938

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
West Virginia.....	.....	1,514	100.0	Virginia.....	162	2,833	94.6
Kentucky.....	.....	1,428	100.0	Ohio.....	363	5,021	93.3
Wisconsin.....	.....	1,235	100.0	Texas.....	149	1,931	92.8
Maryland.....	.....	977	100.0	Massachusetts.....	104	1,248	92.3
New Jersey.....	.....	959	100.0	Minnesota.....	104	1,237	92.2
Florida.....	.....	920	100.0	Pennsylvania.....	1,036	11,851	92.0
Oregon.....	.....	840	100.0	New York.....	328	3,715	91.9
Colorado.....	.....	608	100.0	Vermont.....	181	1,992	91.7
South Dakota.....	.....	458	100.0	United States.....	7,146	70,351	90.8
Nebraska.....	.....	326	100.0	Tennessee.....	271	2,645	90.7
Idaho.....	.....	326	100.0	Kansas.....	160	1,221	88.4
Other States ¹.....	.....	286	100.0	New Hampshire.....	52	303	85.4
Wyoming.....	.....	246	100.0	California.....	538	3,022	84.9
Utah.....	.....	241	100.0	Iowa.....	284	1,391	83.0
Rhode Island.....	.....	182	100.0	Alabama.....	452	1,917	80.9
Arizona.....	.....	176	100.0	Connecticut.....	90	381	80.9
New Mexico.....	.....	102	100.0	Michigan.....	611	2,444	80.0
North Carolina.....	10	952	99.0	Illinois.....	811	3,163	79.6
Indiana.....	62	3,756	98.4	Washington.....	319	886	73.5
Oklahoma.....	15	797	98.2	Arkansas.....	108	135	55.6
Georgia.....	40	1,730	97.7	South Carolina.....	280	185	39.8
Missouri.....	116	3,404	96.7	Montana.....	450	178	28.3
Maine.....	50	1,189	96.0				

¹ Includes Delaware, Louisiana, Mississippi, and Nevada.

TABLE 39.—*Quarries and related plants: Number of man-hours of employment in 1938*

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
Kentucky	-----	2, 455, 624	100. 0	Ohio	669, 697	9, 069, 649	93. 1
West Virginia	-----	2, 396, 446	100. 0	Vermont	288, 571	3, 769, 547	92. 9
Wisconsin	-----	1, 912, 011	100. 0	Texas	296, 453	3, 841, 795	92. 8
Maryland	-----	1, 717, 437	100. 0	Virginia	462, 998	5, 335, 336	92. 0
New Jersey	-----	1, 707, 959	100. 0	New York	597, 292	6, 128, 459	91. 1
Florida	-----	1, 537, 901	100. 0	Tennessee	524, 708	5, 380, 170	91. 1
Colorado	-----	1, 023, 180	100. 0	Pennsylvania	1, 949, 883	19, 527, 259	90. 9
Oregon	-----	790, 483	100. 0	Massachusetts	224, 048	2, 134, 273	90. 5
Other States ¹	-----	697, 249	100. 0	Minnesota	226, 273	2, 092, 450	90. 2
South Dakota	-----	695, 015	100. 0	United States..	13, 506, 404	120, 259, 707	89. 9
Nebraska	-----	672, 995	100. 0	California	1, 257, 772	5, 886, 162	82. 4
Wyoming	-----	493, 795	100. 0	Michigan	1, 004, 610	4, 694, 277	82. 4
Arizona	-----	353, 049	100. 0	Kansas	437, 102	2, 028, 417	82. 3
Utah	-----	351, 092	100. 0	New Hampshire	80, 000	364, 179	82. 0
Rhode Island	-----	313, 518	100. 0	Alabama	778, 273	3, 486, 329	81. 8
Idaho	-----	293, 705	100. 0	Connecticut	174, 600	732, 933	80. 8
New Mexico	-----	81, 121	100. 0	Iowa	589, 633	2, 405, 178	80. 3
North Carolina	24, 300	1, 937, 021	98. 8	Illinois	1, 169, 912	4, 514, 208	79. 4
Indiana	97, 788	5, 992, 110	98. 4	Washington	543, 305	1, 215, 175	69. 1
Georgia	61, 440	3, 039, 521	98. 0	Arkansas	260, 162	308, 819	54. 3
Oklahoma	43, 800	1, 578, 292	97. 3	South Carolina	620, 231	369, 947	37. 4
Missouri	214, 107	5, 373, 223	96. 2	Montana	818, 646	246, 592	23. 1
Maine	90, 800	1, 315, 806	93. 5				

¹ Includes Delaware, Louisiana, Mississippi, and Nevada.

LONG-TIME TREND OF ACCIDENT RATES IN THE QUARRY INDUSTRY

The first year for which the Bureau of Mines collected reports of accidents from all quarrying companies in the United States was 1911. Since then reports have been collected annually. The present bulletin is therefore the twenty-eighth annual publication containing statistical data on accidents in the quarrying industry.

Reports from operating companies for 1911 and several years immediately thereafter, although apparently complete in coverage of fatal accidents, did not appear to be complete for nonfatal injuries. Hence the total number of injuries in the United States, as compiled from the reports, probably did not cover all injuries that actually occurred. Evidence of this is the rapid increase in the number of injuries reported for the several years following 1911, the yearly increase being too large to be reasonably accounted for solely by an increase in the accident-frequency rates based upon the number of men employed.

As far as may be judged the number of reported nonfatal injuries could not be considered complete until 1916. Probably the reports before 1916 were incomplete chiefly as to injuries of a slight nature that disabled the injured worker for only a day or two. Such injuries might have been overlooked or forgotten by the operator when he made his report to the Bureau of Mines, although deaths and serious injuries would have been recorded.

In 1916, when the compiled totals covering all reporting companies seemed to be reasonably complete as to injuries as well as deaths, the reports showed 173 fatalities and 13,427 nonfatal injuries at quarries and related outside works. The number of man-hours of employment or exposure to occupational risk, as far as may be determined from the reports, was 214,692,000. The accident rate for 1916 was therefore 63.35 per million man-hours of exposure. This figure included a fatality rate of 0.81 and an injury rate of 62.54.

From 1916 to 1930 the nonfatal-injury rates showed a gratifying downward trend. There has been little change since that year, although the rate for 1938 was more favorable than that for any previous year. The trend of the yearly rates for fatal accidents also was downward from 1916 until 1932. The 1933 rate, although the highest in recent years, was by no means as high as the 1916 rate. Since then, although the rates have fluctuated, they have not again risen to the level of 1933. (See table 40 and figure 1.)

TABLE 40.—*Employment and accident data for the quarrying and related industries in the United States, 1911-38*

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	230,464,089	154	13,201	.67	57.28
1927.....	91,517	272	24,782,561	9.27	229,805,889	135	13,459	.59	58.57
1928.....	89,667	272	24,397,377	9.22	224,953,034	119	10,568	.53	46.98
1929.....	85,561	268	22,967,579	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	.46	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.....	64,331	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
1937.....	84,094	241	20,264,125	7.81	158,298,530	77	6,348	.49	40.10
1938.....	77,497	223	17,255,828	7.75	133,766,111	82	5,027	.61	37.58

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.

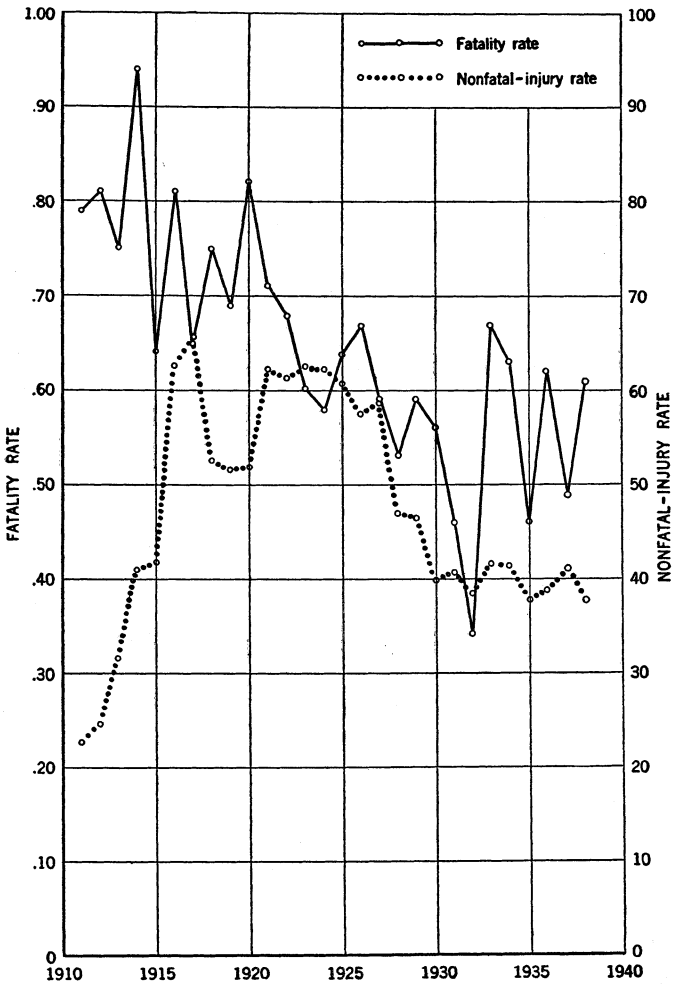


FIGURE 1.—Accident-frequency rates per million man-hours of employment in the quarrying and related industries in the United States, 1911-38.

TABLE 41.—All quarries: Accident and labor data, by kinds of quarries, during the years ended Dec. 31, 1934 to 1938

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
Cement rock:									
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	5,993,209	7,066,507	244	277	272
1937	4,334	22,881	27,215	1,042,005	6,521,786	7,563,791	240	285	278
1938	3,874	21,646	25,520	843,150	5,672,710	6,515,860	218	262	255
Granite:									
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
1937	5,209	3,752	8,961	1,153,001	875,321	2,028,322	221	233	226
1938	4,928	3,467	8,395	1,045,587	753,228	1,798,815	212	217	214
Limestone:									
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
1937	16,563	8,226	24,789	3,246,594	1,762,194	5,008,788	196	214	202
1938	14,416	7,936	22,352	2,603,904	1,570,571	4,174,475	181	198	187
Limestone (chief product, lime):									
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
1937	4,205	6,155	10,360	1,151,626	1,757,662	2,909,288	274	286	281
1938	3,667	5,486	9,153	915,132	1,460,394	2,375,526	250	266	260
Marble:									
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
1937	1,288	2,359	3,647	265,623	573,539	839,162	206	243	230
1938	1,305	2,109	3,414	291,257	508,728	799,985	223	241	234
Sandstone:									
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
1937	2,225	1,017	3,242	444,175	218,378	662,553	200	215	204
1938	2,045	862	2,907	352,297	176,222	528,519	172	204	182
Slate:									
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	204	231	228
1937	1,216	1,858	3,074	281,845	430,515	712,360	232	232	232
1938	1,043	1,572	2,615	202,096	308,623	510,719	194	196	195
Trap rock:									
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
1937	1,839	967	2,806	353,177	186,684	539,861	192	193	192
1938	2,066	1,075	3,141	370,488	181,441	551,929	179	169	176
Total:									
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	5,782,015	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
1937	36,879	47,215	84,094	7,938,046	12,326,079	20,264,125	215	261	241
1938	33,344	44,153	77,497	6,623,911	10,631,917	17,255,828	199	241	223

¹ Included with limestone prior to 1935.

TABLE 42.—All quarries: Accident and labor data, by kinds of quarries, during the years ended Dec. 31, 1934 to 1938

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 outside works	Total	At quarry	At outside works	Total	Killed		Injured		
										At quarry	At outside works	At quarry	At outside works	Total
Cement rock:														
1934	5,438,358	32,301,236	37,737,594	6	12	18	132	327	459	1.10	0.37	24.28	10.12	12.16
1935	5,303,243	32,637,775	37,941,018	3	9	12	90	272	362	.57	.27	16.96	8.01	9.22
1936	7,903,414	43,813,039	51,716,453	3	17	20	248	480	728	.75	.39	31.96	10.96	14.05
1937	7,626,814	48,172,024	55,798,838	7	16	23	216	444	660	.88	.41	27.22	9.22	11.76
1938	6,381,332	42,126,292	48,507,624	8	6	14	131	339	470	1.25	.14	20.53	8.05	9.69
Granite:														
1934	6,117,078	4,883,077	11,000,155	14	1	15	525	251	776	2.29	.20	85.83	51.40	70.54
1935	6,151,107	4,404,309	10,555,416	6	6	12	431	159	570	.98	—	70.07	31.56	54.00
1936	8,503,251	6,200,222	14,703,473	5	—	5	541	222	763	.34	—	63.62	35.81	51.89
1937	9,076,863	7,002,874	16,082,747	7	3	10	7	555	862	.44	—	61.12	43.84	53.90
1938	8,046,819	5,998,374	14,044,993	23	2	25	395	183	578	2.86	.33	49.09	30.51	41.15
Limestone:														
1934	20,695,528	14,963,114	35,658,642	16	1	17	1,488	537	2,025	.77	.07	71.90	35.39	56.79
1935	19,138,003	9,498,822	28,636,825	4	4	8	1,173	378	1,551	.63	.42	.56	61.29	39.79
1936	25,374,123	12,978,862	38,352,985	21	13	34	1,561	514	2,075	.83	1.00	.89	61.52	39.60
1937	26,103,531	14,614,095	40,717,626	16	7	23	1,655	518	2,173	.61	.48	.66	63.40	35.45
1938	20,763,959	12,746,989	33,512,948	16	6	22	1,379	513	1,892	.77	.47	.66	66.41	56.46
Limestone (chief product, lime):														
1934	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
1935	6,464,768	10,095,798	16,560,566	8	—	8	498	370	861	1.24	—	75.95	36.05	51.99
1936	8,134,208	12,516,668	20,650,876	7	5	12	598	520	1,118	.86	.40	58.52	54.14	54.14
1937	8,906,160	13,579,755	22,485,915	3	3	6	647	572	1,219	.79	.22	72.65	42.12	54.21
1938	6,951,358	11,140,144	18,091,502	7	7	14	509	437	936	1.01	.63	73.22	38.33	51.74
Marble:														
1934	988,700	2,520,283	3,508,983	1	1	2	63	87	150	1.01	.40	63.72	34.52	42.75
1935	1,195,136	2,821,683	4,016,819	1	2	3	70	106	176	.35	.25	58.57	37.57	43.52
1936	1,602,717	5,098,903	6,701,620	1	2	3	85	165	250	.50	.39	53.03	32.36	37.30
1937	2,247,925	4,625,765	6,873,690	1	1	2	123	350	473	.54	.72	54.72	49.07	50.92
1938	2,462,034	4,096,528	6,558,562	1	1	2	190	192	382	.41	.15	77.17	46.87	58.24
Sandstone:														
1934	1,290,775	1,145,253	2,436,028	2	—	2	121	33	154	1.55	—	93.74	28.51	63.22
1935	2,242,757	1,445,378	3,688,135	1	—	1	202	41	243	.30	—	90.07	28.37	66.80
1936	3,337,562	1,820,066	5,166,628	1	1	2	181	67	248	.82	.55	79.93	36.93	47.00
1937	3,678,045	1,833,076	5,511,121	3	1	4	294	117	411	.73	.73	79.93	33.53	74.58
1938	1,868,458	1,465,071	4,333,529	2	—	2	203	49	252	.70	—	70.77	33.40	58.19

Slate:	704, 542	1, 428, 073	1	1	47	36	83	82	.53	66, 71	49, 76	58, 12
1934	1, 218, 327	3, 097, 339	0	1	105	63	168	3, 51	.65	86, 18	33, 53	54, 24
1935	1, 706, 451	4, 889, 520	0	0	125	129	254	2, 07	1.23	73, 17	40, 55	51, 94
1936	2, 414, 320	6, 042, 334	5	1	166	172	338	2, 07	.28	68, 76	47, 41	55, 94
1937	1, 706, 300	4, 277, 687	1	1	108	135	243	.59	.23	63, 29	52, 50	56, 81
1938	2, 215, 096	3, 489, 405	6	1	206	71	277	2, 71	1.72	93, 00	55, 72	79, 38
Trap rock:	2, 551, 890	4, 235, 223	5	1	150	71	221	1, 96	.59	58, 78	42, 18	52, 18
1934	3, 100, 638	4, 494, 368	7	1	195	86	281	2, 26	.69	62, 89	50, 89	58, 06
1935	1, 958, 875	4, 474, 358	2	2	274	61	335	1, 69	1.28	94, 00	39, 11	74, 87
1936	2, 374, 941	4, 474, 358	4	1	213	61	274	1, 34	.68	71, 57	41, 69	61, 72
1937	2, 975, 990	4, 438, 266	4	1	252	61	274	1, 34	.68	71, 57	41, 69	61, 72
1938	37, 448, 077	95, 258, 880	45	15	2, 582	1, 342	3, 024	1, 20	.26	68, 95	23, 21	41, 19
Total:	44, 267, 301	110, 023, 341	35	16	2, 712	1, 440	4, 152	1, 70	.24	61, 26	21, 90	37, 73
1934	59, 755, 364	147, 087, 448	57	38	3, 534	2, 183	5, 717	1, 89	.62	69, 14	23, 00	38, 87
1935	63, 283, 000	158, 268, 530	47	30	3, 820	2, 418	6, 348	1, 74	.49	62, 10	23, 45	40, 10
1936	81, 608, 061	133, 766, 111	60	22	3, 128	1, 869	5, 027	1, 15	.27	56, 97	23, 27	37, 98

1 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 1938, received reports from many plants that were operated by noncommercial agencies, such as States, counties, cities, and the Works Progress Administration. Similar reports had previously been received for 1936 and 1937. 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 for any of the 3 years mentioned. All reports received, however, were tabulated, and the results for 1938 are shown in tables 43 to 46. Similar tables for 1936 and 1937 were published in previous issues of this bulletin.

The reports on noncommercial quarries covered 392 plants operating in 35 States in 1938 and having a total working force of 13,047 men and a total of 18.8 million man-hours of labor performed, an average of 179 days or 1,438 hours per man. The reports showed a weighted average workday of 8 hours. States having the largest number of employees were Iowa, Kansas, Illinois, Virginia, and Ohio. Most of the quarries reported that the stone produced was used chiefly for surfacing roads.

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 3 fatalities and 645 nonfatal lost-time injuries. These figures showed a fatality rate of 0.16 and an injury rate of 34.38 per million man-hours of work done by all employees during the year. Included among the nonfatal injuries were 2 cases of permanent total disability, 14 of permanent partial disability, and 629 of temporary injury.

All of the plants for which reports were received were open quarries. One fatality was caused by handling materials, one by explosives, and one by electricity. Nonfatal injuries resulted mainly from handling materials; this cause comprised more than a third of the total number of injuries to employees inside the quarries. Other important causes of accidents were flying objects and hand tools.

Of the total number of accidents 613 were incident to quarry work, and 35 occurred in connection with work outside the quarries.

TABLE 43.—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, 1938

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 works	At out-side works	Total	At quarry	At outside works	Total	At quarry	At out-side works	Total	At quarry	At outside works	Total
Illinois.....	36	1,199	189	1,388	209,322	30,147	239,469	175	160	173	1,695,308	237,691	1,932,999
Indiana.....	15	259	130	389	83,495	18,066	101,561	129	144	134	257,360	149,025	416,385
Iowa.....	48	1,219	430	1,649	235,791	79,130	314,921	196	184	193	1,757,006	575,254	2,332,260
Kansas.....	41	1,185	374	1,559	183,118	41,879	224,997	155	112	144	1,464,940	335,036	1,799,976
Kentucky.....	15	342	91	433	70,093	19,219	89,312	205	211	206	594,682	166,648	761,330
Michigan.....	7	120	39	159	17,924	4,052	22,006	149	105	138	140,828	34,013	180,941
Missouri.....	17	743	73	816	131,558	11,503	143,061	177	158	175	1,061,968	107,774	1,169,742
New York.....	33	654	187	841	86,598	22,326	108,924	132	119	130	622,206	108,508	830,714
North Carolina.....	3	84	34	118	19,837	8,430	28,267	236	245	240	374,986	79,440	454,426
Ohio.....	15	763	167	930	169,759	33,240	202,999	222	199	218	1,344,818	263,004	1,607,822
Oklahoma.....	10	143	68	211	25,330	6,955	32,285	177	98	152	344,810	53,740	438,550
Oregon.....	21	186	65	251	21,270	7,327	28,597	114	113	113	162,430	56,023	218,453
Pennsylvania.....	4	70	11	81	13,068	2,400	15,468	157	215	101	1,014,533	37,308	1,051,841
Tennessee.....	34	646	184	830	153,279	44,061	197,340	237	243	238	1,204,632	370,888	1,642,520
Virginia.....	21	753	209	962	121,865	35,831	157,696	162	171	165	1,068,931	33,144	1,102,075
Washington.....	11	39	33	72	6,260	4,140	10,400	169	129	146	359,373	64,609	423,982
Wisconsin.....	11	282	62	344	47,709	8,014	55,723	160	129	162	359,373	64,609	423,982
Other States ²	50	1,635	379	2,014	339,789	73,308	413,297	208	194	205	2,722,727	587,163	3,309,890
Total.....	392	10,322	2,725	13,047	1,889,231	451,158	2,340,389	183	166	179	15,135,795	3,622,390	18,758,185

¹ Operated by States, counties, municipalities, and the Works Progress Administration. Includes quarries producing limestone, granite, trap rock, marble, 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, California, Colorado, Florida, Georgia, Idaho, Maine, Massachusetts, Minnesota, Montana, Nebraska, New Mexico, South Dakota, Texas, Vermont, and West Virginia.

TABLE 44.—*Noncommercial quarries: Accidents by States and severity of injury, during the year ended Dec. 31, 1938*

State	Killed	Injured				Grand total
		Perma- nent total ¹	Perma- nent partial ²	Tempo- rary ³	Total non- fatal	
Illinois.....				78	78	78
Indiana.....				2	2	2
Iowa.....	2		4	114	118	120
Kansas.....			1	26	27	27
Kentucky.....			1	43	43	43
Michigan.....				2	2	2
Missouri.....				34	34	34
New York.....			1	57	58	58
North Carolina.....			1	14	15	15
Ohio.....				12	12	12
Oklahoma.....				3	3	3
Oregon.....			1	25	26	26
Pennsylvania.....						
Tennessee.....			1	33	34	34
Virginia.....	1	2	5	48	55	56
Washington.....				1	1	1
Wisconsin.....				14	14	14
Other States ⁴				123	123	123
Total.....	3	2	14	629	645	648

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, California, Colorado, Florida, Georgia, Idaho, Maine, Massachusetts, Minnesota, Montana, Nebraska, New Mexico, South Dakota, Texas, Vermont, and West Virginia.

TABLE 45.—*Noncommercial quarries: Fatalities and injuries and rates per million man-hours, by States, during the year ended Dec. 31, 1938*

State	Number killed			Number injured			Widows	Orphans	Rates per million man-hours					
	Open quarry	Outside works	Total	Open quarry	Outside works	Total			Killed			Injured		
									At quarry	At outside works	Total	At quarry	At outside works	Total
Illinois.....				77	1	78					45.42	4.21	40.35	
Indiana.....				2		2					7.48		4.80	
Iowa.....	2		2	116	2	118	1	2	1.14	0.86	66.00	3.48	50.53	
Kansas.....				22	5	27					15.02	14.92	15.00	
Kentucky.....				40	3	43					67.26	18.00	56.48	
Michigan.....				1	1	2					6.81	29.40	11.05	
Missouri.....				31	3	34					29.19	27.84	29.07	
New York.....				57	1	58					86.08	5.93	69.82	
North Carolina.....				15		15					83.47		57.83	
Ohio.....				12		12					8.93		7.46	
Oklahoma.....				1	2	3					4.93	37.57	11.72	
Oregon.....				23	3	26					141.60	53.55	119.02	
Pennsylvania.....														
Tennessee.....				33	1	34					25.95	2.70	20.70	
Virginia.....	1		1	51	4	55		.91		.71	46.62	12.44	38.85	
Washington.....				1		1					19.87		11.98	
Wisconsin.....				14		14					39.73		33.57	
Other States ¹				114	9	123					41.87	15.33	37.16	
Total.....	3		3	610	35	645	1	2	.20	.16	40.30	9.66	34.38	

¹ Includes Alabama, Arizona, Arkansas, California, Colorado, Florida, Georgia, Idaho, Maine, Massachusetts, Minnesota, Montana, Nebraska, New Mexico, South Dakota, Texas, Vermont, and West Virginia.

TABLE 46.—*Noncommercial quarries: Accidents by causes and severity of injury during the year ended Dec. 31, 1938*

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		1	2	40	43	43
2. Handling materials	1	1	2	240	243	244
3. Hand tools			1	61	62	62
4. Explosives	1		2	10	12	13
5. Haulage				25	25	25
6. Falls of persons			1	57	58	58
7. Falling objects (other than 1 and 2)				19	19	19
8. Flying objects			3	86	89	89
9. Electricity	1			1	1	2
10. Drilling and channeling (by machine or hand)				8	8	8
11. Machinery			2	27	29	29
12. Stepping on nail				2	2	2
13. Boiler and air-tank explosions						
14. Burns				2	2	2
15. Other causes				17	17	17
Total	3	2	13	595	610	613
At outside works:						
1. Haulage				1	1	1
2. Machinery				17	17	17
3. Hand tools				3	3	3
4. Stepping on nail						
5. Electricity						
6. Falls of persons				1	1	1
7. Falling objects (rocks, timbers, etc.)				5	5	5
8. Flying objects			1	3	4	4
9. Handling materials				1	1	1
10. Burns						
11. Other causes				3	3	3
Total			1	34	35	35
Grand total	3	2	14	629	645	648

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

Several questionnaire forms were used by the Bureau of Mines in conducting its canvass of accidents and employment in the quarrying industry in 1938. One of the forms was designed specially for the cement industry, another for the lime industry, and a third for all other classes of quarries. The general form for all quarries except those whose production was used for making cement or lime is shown in figures 2 and 3.

ACCIDENTS DURING THE YEAR ENDED DECEMBER 31, 1938

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

UNDERGROUND QUARRY (MINE)									
	Killed	Perma- nent total disability ¹	Perma- nent partial disability ²	Temporary injuries (disability more than remainder of day of accident)		Killed	Perma- nent total disability ¹	Perma- nent partial disability ²	Temporary injuries (disability more than remainder of day of accident)
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 fires.....					22. Other causes.....				
(g) Suffocation from natural gases.....									
(h) Turbush of water.....					Total number killed or injured by shaft accidents.....				

MILL OR OTHER OUTSIDE WORK (See item 2 on face of this schedule)									
	Killed	Perma- nent total disability ¹	Perma- nent partial disability ²	Temporary injuries (disability more than remainder of day of accident)		Killed	Perma- nent total disability ¹	Perma- nent partial disability ²	Temporary injuries (disability more than remainder of day of accident)
Number killed or injured by—					Number killed or injured by—Contd.				
1. Haulage:					6. Electricity:				
(a) Hand and animal.....					(a) Direct contact with trolley wire.....				
(b) Mechanical.....					(b) Bar or tool striking trolley wire.....				
(c) Railway cars and locomotives.....					(c) Contact with motor.....				
2. Machinery:					(d) Others.....				
(a) Hoisting cables and attachments.....					7. Falls of persons.....				
(b) Guys, cranes, derricks, and attachments.....					8. Falling objects (rocks, timber, etc.).....				
(c) Pumps and hoisting engines.....					9. Flying objects:				
(d) Crushers.....					(a) From sledging.....				
(e) Other machinery.....					(b) From crushing.....				
3. Hand tools.....					(c) Others.....				
4. Stepping on nail.....					10. Handling materials:				
					(a) Handling rock by hand.....				
					(b) Handling other materials.....				
					11. Burns.....				
					12. 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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