

# Injury Ratios

*An alternative approach for safety professionals*

**By Fred A. Manuele**

**I**N HEINRICH REVISITED: *Truisms or Myths*, safety practitioners were advised to be cautious about H.W. Heinrich's frequently used 300-29-1 ratios—the no injury, minor injury, major injury ratios. A case was made that their validity is doubtful [Manuele(a)].

Several safety professionals responded to that caution with comments for which this composite is illustrative: "I've read what you wrote and why you question the application of the 300-29-1 ratios, but sometimes using injury ratios is convincing. What will replace what I have been using?" This is an appropriate question and prompted a study to determine whether replacement injury ratios could be produced.

A disturbing influence also encouraged this study of injury ratios. It came from a colleague who provided data on ratios for a few industries relating fatalities to OSHA recordable incidents. An immediate response to that data was, "This can't be right—fatalities couldn't possibly occur that often in relation to recordable incidents." In some industries, the record is much worse than expected. As this study progressed, the record for some industries was also found to be much worse than anticipated, with respect to the relationship

between OSHA recordable incidents and lost workday cases.

When discussing efforts to address severe injury potential, several premises are key:

- Most incidents resulting in severe injury are unique events.
- Typical safety initiatives that concentrate on the types of incidents that occur frequently do not address low probability/high consequence types of incidents.
- Specially directed initiatives are necessary to identify and ameliorate the potential for the occurrence of low-probability/high-consequence incidents [Manuele(b)].

The injury and fatality ratios in this article promote the observation that severe injury potential could profitably be given more attention in some industries.

Alan Hoskins, manager of the statistics department at National Safety Council and a renowned injury statistician, reviewed this article. He asked whether the data presented on fatalities in relation to OSHA recordable incidents would be of value to safety practitioners since fatalities occur infrequently. That's a good point.

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**Table 1**

## Variations by Industry

		Private Industry	Individual Industry Extremes	
LWDC* to total injuries and illnesses	Ratio	1:2.06	1:2.70	1:1.38
	Percent	49	37	73
Relation: DAFWC/LWDC	Percent	61	40	94
Fatalities to total injuries and illnesses	Ratio	1:1,031	1:4,958	1:91

\*Lost workday cases.

## Identifying Serious Injury Potential

How does one go about looking for latent serious injury potential?

- Adopt a mindset that specifically seeks to identify the potential for low probability/severe consequence events.
- Understand the invalidity of the premise that efforts focused on the types of accidents that occur frequently will also encompass low-probability types of accidents that result in severe injury.
- Perform a self-evaluation with respect to what Reason says about latent conditions in *Managing the Risks of Organizational Accidents*, and determine whether decision making over time has resulted in the accumulation of hazardous conditions and practices for which the risks are accepted within the organization's culture.

Latent conditions, such as poor design, gaps in supervision, undetected manufacturing defects or maintenance failures, unworkable procedures, clumsy automation, shortfalls in training, less than adequate tools and equipment, may be present for many years before they combine with local circumstances and active failures to penetrate the system's layers of defenses (10).

- Examine your incident investigation system to determine whether systemic root causal factors that have serious injury potential are identified, or whether the system in place is described by this excerpt from the Report of the Columbia Accident Investigation Board.

Many accident investigations do not go far enough. They identify the technical cause of the accident, and then connect it to a variant of "operator error"—the line worker who forgot to insert the bolt, the engineer who miscalculated the stress or the manager who made the wrong decision. But this is seldom the entire issue. When the determinations of the causal chain are limited to the technical flaw and individual failure, typically the actions taken to prevent a similar event in the future are also limited: fix the technical problem and replace or retrain the individual responsible. Putting these corrections in place leads to another mistake—the belief that the problem is solved. The Board did not want to make these errors (97).

- Have a look at how near hits are investigated to determine whether serious injury potential is properly addressed.
- Adopt a modification of the critical incident technique whereby employees are asked for their input on serious injury potential, even though serious injuries have not yet occurred in what they believe to be hazardous situations.
- Institute a prejob planning and safety review system that has a specific focus on identifying and ameliorating serious injury potential.

But, infrequently is a relative term. Consider the following about frequency of fatalities in relation to nonfatal incidents. Composite data for private industry, taken from Bureau of Labor Statistics (BLS) publications for the three years 1999, 2000 and 2001, produce these ratios:

- Fatalities to total injuries and illnesses: One to 1,031.
- Fatalities to lost workday cases: One to 501.
- Fatalities to lost workday cases with days away from work: One to 305.

As a beginning for this project to produce injury ratios, Heinrich's definitions and ratios were reviewed to determine whether they could be built upon. In the fourth edition of *Industrial Accident Prevention*, Heinrich writes:

Analysis proves that, in the average case, for every mishap resulting in an injury there are many other similar accidents that cause no injuries whatsoever. From a review of the data available concerning the frequency of potential-injury accidents, it is estimated that in a unit group of 330 accidents of the same kind *and involving the same person*, 300 result in no injuries, 29 in minor injuries, and one in a major lost-time injury (italics are Heinrich's) (26).

It may be that reliable data on no-injury accidents has recently been collected by some organizations, but a search for it proved unfruitful; gathering such data would require a special and expensive long-term study. Next, Heinrich's definitions for minor injury and major injury categories were reviewed to determine whether they would provide a lead for further inquiry.

He defines minor injuries as "a scratch, bruise or laceration such as is commonly termed a first aid case" (30). Valid, broad-scale, published data on the relationship of first-aid cases to major injuries has not been located.

Heinrich defines a major injury as "any case that is reported to insurance carriers or to the state compensation commissioner" (30). Heinrich's study was made in the 1920s. At that time, few companies were self-insured. Thus, all injuries except those treated internally as first-aid cases would be reported to the applicable workers' compensation insurance provider.

Considering this fact, the following extrapolation is offered concerning the Heinrich ratios: Since minor injuries are exclusively first-aid cases, all other injuries would fall in the major injury category. Thus, it is postulated that every OSHA recordable injury

**Table 2**

**Base Document 1**

This table shows ratios and percentages of lost workday cases (LWDC) to total injuries and illnesses, and LWDC with days away from work (DAFW) to total LWDC: Aggregate for the years 1999, 2000 and 2001. Total number of injuries and illnesses, total LWDC and number of LWDC with DAFW are expressed in thousands.

	<b>SIC Code</b>	<b>Incident Rate, Total Cases</b>	<b>Total No. Injuries &amp; Illnesses</b>	<b>Total LWDC</b>	<b>Ratio LWDC to Total Injuries &amp; Illnesses</b>	<b>Percent LWDC of Total Injuries &amp; Illnesses</b>	<b>Total LWDC with DAFW</b>	<b>Ratio LWDC with DAFW to Total LWDC</b>	<b>Percent LWDC with DAFW of Total LWDC</b>
Private industry		6.0	16,572.9	8,054.0	1:2.06	49	4,904.1	1:1.64	61
<b>Group A</b>									
Transportation by air	45	13.5	421.4	289.2	1:1.46	69	199.5	1:1.45	69
Transportation equipment mfg.	37	13.3	743.7	347.3	1:2.14	47	138.2	1:2.51	40
Fabricated metal products	34	11.9	542.1	256.4	1:2.11	47	178.9	1:1.43	70
Primary metal industries	33	12.1	257.6	127.1	1:2.03	49	59.9	1:1.84	54
Food & kindred products mfg.	20	12.0	612.5	358.0	1:1.71	58	209.7	1:1.71	59
Lumber & wood products mfg.	24	11.9	285.3	146.0	1:1.95	51	81.7	1:1.79	56
Stone, clay & glass products	32	10.4	183.2	94.6	1:1.94	52	51.4	1:1.84	54
Local & interurban passenger transit	41	9.0	101.0	54.2	1:1.86	54	39.8	1:1.36	73
<b>Group B</b>									
Industrial machinery & equipment mfg.	35	7.8	498.4	216.8	1:2.30	43	114.0	1:1.90	53
General building contractors	15	7.6	304.6	147.4	1:2.07	48	114.9	1:1.28	78
Coal mining	12	7.3	17.9	13.0	1:1.38	73	12.2	1:1.07	94
Agricultural services	07	7.0	189.7	91.9	1:2.06	48	68.1	1:1.35	74
Water transportation	44	7.0	36.0	20.7	1:1.74	58	17.8	1:1.16	86
Agricultural production—crops	01	6.9	84.1	41.8	1:2.01	50	27.3	1:1.53	65
Wholesale trade: Nondurable goods	51	6.8	539.2	310.1	1:1.74	58	189.7	1:1.63	61
Social services	83	5.9	385.1	183.0	1:2.10	48	126.3	1:1.45	69
<b>Group C</b>									
Oil & gas exploration	13	3.7	36.4	20.1	1:1.81	55	14.8	1:1.36	74
Transportation services	47	3.3	42.3	25.4	1:1.67	60	16.4	1:1.55	65
Personal services	72	3.1	88.6	45.8	1:1.93	52	28.0	1:1.64	61
Business services	73	3.0	519.1	243.8	1:2.13	47	159.8	1:1.53	66
Educational services	82	3.0	113.0	41.9	1:2.70	37	31.2	1:1.34	74
Membership organizations	86	3.0	64.6	26.1	1:2.48	40	19.3	1:1.35	74
Communications utilities	48	2.9	135.6	80.3	1:1.69	59	58.9	1:1.36	73
Engineering & management services	87	1.7	158.8	66.8	1:2.38	42	47.2	1:1.42	71

**Table 3**

### Sorting from Base Document 1: A

Sorting to show ratios and percentages of LWDC to total injuries and illnesses: Aggregate for the years 1999, 2000 and 2001. Total number of injuries and illnesses, total LWDCs and number of LWDC with DAFW are expressed in thousands.

	SIC Code	Incident Rate, Total Cases	Total No. Injuries & Illnesses	Total LWDC	Ratio LWDC to Total Injuries & Illnesses	Percent LWDC of Total Injuries & Illnesses	Group
Educational services	82	3.0	113.0	41.9	1:2.70	37	C
Engineering & management services	87	1.7	158.8	66.8	1:2.38	42	C
Industrial machinery & equipment mfg.	35	7.8	498.4	216.8	1:2.30	43	B
Transportation equipment mfg.	37	13.3	743.7	347.3	1:2.14	47	A
Business services	73	3.0	519.1	243.8	1:2.13	47	C
Fabricated metal products	34	11.9	542.1	256.4	1:2.11	47	A
Social services	83	5.9	385.1	183.0	1:2.10	48	B
General building contractors	15	7.6	304.6	147.4	1:2.07	48	B
Agricultural services	07	7.0	189.7	91.9	1:2.06	48	B
Private industry		6.0	16,572.9	8054.0	1:2.06	49	
Primary metal industries	33	12.1	257.6	127.1	1:2.03	49	A
Agricultural production—crops	01	6.9	84.1	41.8	1:2.01	50	B
Lumber & wood products mfg.	24	11.9	285.3	146.0	1:1.95	51	A
Stone, clay & glass products	32	10.4	183.2	94.6	1:1.94	52	A
Personal services	72	3.1	88.6	45.8	1:1.93	52	C
Local & interurban passenger transit	41	9.0	101.0	54.2	1:1.86	54	A
Oil & gas exploration	13	3.7	36.4	20.1	1:1.81	55	C
Water transportation	44	7.0	36.0	20.7	1:1.74	58	B
Wholesale trade: Nondurable goods	51	6.8	539.2	310.1	1:1.74	58	B
Food & kindred products mfg.	20	12.0	612.5	358.0	1:1.71	58	A
Communications utilities	48	2.9	135.6	80.3	1:1.69	59	C
Transportation services	47	3.3	42.3	25.4	1:1.67	60	C
Transportation by air	45	13.5	421.4	289.2	1:1.46	69	A
Coal mining	12	7.3	17.9	13.0	1:1.38	73	B

fits in the major injury category. Several safety practitioners were asked whether they could come up with an exception to that premise, keeping in mind Heinrich's definitions, and none has yet arisen.

It is understood that safety practitioners and risk managers might not place injuries requiring a minimum of medical attention in a major injury category. But, in a strict application of Heinrich's definitions, such injuries would be so categorized.

Data on OSHA recordable injuries and illnesses

and fatalities are available, from which ratios can be derived, with caution; these data were chosen for the base of this study. Hoskins properly suggested that this caution be emphasized because of the possibility of substantive sampling errors for industries reporting relatively small numbers of injuries.

Further, it must be recognized that the accuracy of reporting for OSHA statistics varies considerably by and within reporting entities. But, since the ratios provided here are cumulative for a three-year term,

**Table 4**

**Sorting from Base Document 1: B**

Sorting to show ratios and percentages that LWDC with DAFW are to total LWDC: Aggregate for the years 1999, 2000 and 2001. Number of injuries and illnesses, total LWDC, and LWDC with DAFW are shown in thousands.

	SIC Code	No. Injuries & Illnesses	Total LWDC	LWDC with DAFW	Ratio LWDC with DAFW to Total LWDC	Percent LWDC with DAFW of Total LWDC	Group
Transportation equipment mfg.	37	743.7	347.3	199.5	1:2.51	40	A
Industrial machinery & equipment mfg.	35	498.4	216.8	114.0	1:1.90	53	B
Primary metal industries	33	257.6	127.1	59.9	1:1.84	54	A
Stone, clay & glass products	32	183.2	94.6	51.4	1:1.84	54	A
Lumber & wood products mfg.	24	285.3	146.0	81.7	1:1.79	56	A
Food & kindred products mfg.	20	612.5	358.0	209.7	1:1.71	59	A
Personal services	72	88.6	45.8	28.0	1:1.64	61	C
Private industry		16,572.9	8,054.0	4,904.1	1:1.64	61	
Wholesale trade: Nondurable goods	51	539.2	310.1	189.7	1:1.63	61	B
Transportation services	47	42.3	25.4	16.4	1:1.55	65	C
Agricultural production—crops	01	84.1	41.8	27.3	1:1.53	65	B
Business services	73	519.1	243.8	159.8	1:1.53	66	C
Transportation by air	45	421.4	289.2	199.5	1:1.45	69	A
Social services	83	385.1	183.0	126.3	1:1.45	69	B
Fabricated metal products	34	542.1	256.4	178.9	1:1.43	70	A
Engineering & management services	87	158.8	66.8	47.2	1:1.42	71	C
Communications utilities	48	135.6	80.3	58.9	1:1.36	73	C
Local & interurban passenger transit	41	101.0	54.2	39.8	1:1.36	73	A
Oil & gas exploration	13	36.4	20.1	14.8	1:1.36	74	C
Agricultural services	07	189.7	91.9	68.1	1:1.35	74	B
Educational services	82	113.0	41.9	31.2	1:1.34	74	C
Membership organizations	86	64.6	26.1	19.3	1:1.35	74	C
General building contractors	15	304.6	147.4	114.9	1:1.28	78	B
Water transportation	44	36.0	20.7	17.8	1:1.16	86	B
Coal mining	12	17.9	13.0	12.2	1:1.07	94	B

the data on which they are based are substantive. It has value for safety practitioners as a base for inquiry and comparison as respects the entities for which they influence.

**Reading the Tables**

The references used for the tables were two BLS publications. They can be accessed at <http://www.bls.gov/iif/home.htm>.

•Tables 1 and 2 from “Workplace Injuries and Illnesses in 1999, 2000 and 2001.”

•Table A-1 from “National Census of Fatal Occupational Injuries.”

Only two-digit SIC codes appear in the tables, as is data in Table 1 of the BLS publication “Workplace Injuries and Illnesses in 2001, USDL 02-687.” For all SIC codes shown in that publication, the incidence rates are listed—highest to lowest. To establish a man-



ageable database, 24 industry categories were selected. Group A: The eight having the highest incidence rates; Group B: The eight with incidence rates clustered around a selected midpoint between the highest and the lowest; and Group C: The eight having the lowest incidence rates. In Tables 2 through 6, industries are listed by incidence rates in descending order.

Entries for the total number of injuries and illnesses, the total number of lost workday cases, and the number of days away from work cases are expressed in thousands.

As the resource data indicates, total lost workday cases (LWDC) involve days away from work (DAFW), days of restricted work activity, or both; DAFW cases include those which result in DAFW with or without restricted work activity.

An appropriate conclusion from this study is that variations by industry in all ratio categories are so great that comparing any industry's ratios to a universally established ratio, such as the ratios for private industry as a whole, may result in conclusions of limited value. Observe the magnitude of these variations in Table 1.

There is value in an entity computing its own ratios and percentages, setting goals with respect to them and tracking progress. Also, there is some validity in comparing an individual entity's ratios and percentages with those for its industry, keeping in mind the variations in the quality of injury reporting.

Take care in reviewing the tables. Differences in the data by industry are substantive. Why the records by industry differ so greatly cannot be explained other than by generality. Clearly, occupational risks in the various industries differ greatly; one could speculate on the impact of industry culture with respect to risk taking and what is acceptable. Examining these variations would be an interesting research project.

Table 2 is a base document that gives industry names; SIC codes; incidence rates in descending order; and—by industry—the ratios and percentages of workday cases to total injuries and illnesses, and of LWDC with DAFW to total LWDC. The large variations noted are clear.

Table 3 is a sorting from Table 2, showing the ratios and percentages of LWDC to total injuries and illnesses, in ascending order with respect to percentages. This data generated some interesting questions and prompted the development of Table 5.

Table 4 is also a sorting from Table 2, showing ratios and percentages that LWDC with DAFW are to total LWDC.

Table 5 has two purposes. First, it shows a distribution of the percent that LWDC are of total injuries and illnesses. For 17 of the 24 industry categories, the range is between 45 and 59 percent. The second distribution showing the percent that DAFW cases are of the total LWDC, produces a mystery. For three of the eight industries in Group A, 65 percent or more of the LWDC resulted in DAFW cases. That is the case for 13 of 16 industries in Groups B and C. Interesting discussion could

**Table 5**

## Distributions

For three of eight industries in Group A, 65 percent or more of the lost workday cases resulted in days away from work cases. That is the case for 13 of 16 industries in Groups B and C.

Distribution: Percent that LWDC are of total injuries and illnesses.

Percentage Range	Groups			Total
	A	B	C	
75+				0
70 to 74		1		1
65 to 69	1			1
60 to 64			1	1
55 to 59	3	1	1	5
50 to 54	2	1	1	5
45 to 49	3	3	1	7
40 to 44		1	2	3
35 to 39			1	1
				<b>24</b>

Distribution: Percent that DAFW cases are of total LWDC.

Percentage Range	Groups			Total
	A	B	C	
75+		3		3
70 to 74	2	1	5	8
65 to 69	1	2	2	5
60 to 64		1	1	2
55 to 59	2			2
50 to 54	2	1		3
45 to 49				0
40 to 44	1			1
35 to 39				0
				<b>24</b>

take place concerning this peculiarity, about which research would be valuable.

Table 6 is also a base document that gives industry names; SIC codes; incidence rates in descending order; and—by industry—number of fatalities, injuries and illnesses, LWDC and DAFW cases. Data is computed for the ratios of fatalities to the total number of incidents, fatalities to LWDC, and fatalities to LWDC with DAFW.

Table 7 is a sorting from Table 6, showing the ratio of fatalities to total injuries.

- Five of the eight industries in Group A—those with the highest incidence rates—are within the eight industries with the most favorable ratios of fatalities to total injuries.

- Five of the eight industries in Group B—those with the mid-level incidence rates—are within the

**Table 6**

**Base Document 2**

Ratios of number of fatalities to total injuries and illnesses, to total LWDC, and to LWDC with DAFW: Aggregate for the years 1999, 2000 and 2001. Total number of injuries and illnesses, total LWDC and number of LWDC with DAFW are expressed in thousands.

	<b>SIC Code</b>	<b>Incident Rate, Total Cases</b>	<b>No. of Fatalities</b>	<b>Total No. of Injuries &amp; Illnesses</b>	<b>Ratio Fatalities to Total Injuries &amp; Illnesses</b>	<b>Total LWDC</b>	<b>Ratio Fatalities to Total LWDC</b>	<b>No. of LWDC with DAFW</b>	<b>Ratio of Fatalities to LWDC with DAFW</b>
Private industry		6.0	16,075	16,572.9	1:1,031	8,054.0	1:501	4,904.1	1:305
<b>Group A</b>									
Transportation by air	45	13.5	256	421.4	1:1,646	289.2	1:1,130	199.5	1:779
Transportation equipment mfg.	37	13.3	150	743.7	1:4,958	347.3	1:2,315	138.2	1:921
Fabricated metal products	34	11.9	143	542.1	1:3,791	256.4	1:1,793	178.9	1:1,041
Primary metal industries	33	12.1	137	257.6	1:1,880	127.1	1:927	59.9	1:437
Food & kindred products mfg.	20	12.0	208	612.5	1:2,944	358.0	1:1,721	209.7	1:1,008
Lumber & wood products mfg.	24	11.9	527	285.3	1:541	146.0	1:277	81.7	1:155
Stone, clay & glass products	32	10.4	141	183.2	1:1,299	94.6	1:670	51.4	1:365
Local and interurban passenger transit	41	9.0	266	101.0	1:380	54.2	1:203	39.8	1:150
<b>Group B</b>									
Industrial machinery & equipment mfg.	35	7.8	143	498.4	1:3,485	216.8	1:1,516	114.0	1:797
General building contractors	15	7.6	559	304.6	1:545	147.4	1:264	114.9	1:206
Coal mining	12	7.3	117	17.9	1:153	13.0	1:111	12.2	1:104
Agricultural services	07	7.0	568	189.7	1:334	91.9	1:162	68.1	1:129
Water transportation	44	7.0	144	36.0	1:250	20.7	1:144	17.8	1:124
Agricultural production—crops	01	6.9	928	84.1	1:91	41.8	1:45	27.3	1:29
Wholesale trade: Nondurable goods	51	6.8	305	539.2	1:1,768	310.1	1:1,017	189.7	1:622
Social services	83	5.9	81	385.1	1:4,754	183.0	1:2,259	126.3	1:1,559
<b>Group C</b>									
Oil & gas exploration	13	3.7	231	36.4	1:158	20.1	1:87	14.8	1:64
Transportation services	47	3.3	61	42.3	1:693	25.4	1:416	16.4	1:269
Personal services	72	3.1	121	88.6	1:732	45.8	1:379	28.0	1:231
Business services	73	3.0	551	519.1	1:942	243.8	1:442	159.8	1:290
Educational services	82	3.0	113	113.0	1:1,000	41.9	1:371	31.2	1:276
Membership organizations	86	3.0	90	64.6	1:718	26.1	1:290	19.3	1:214
Communications utilities	48	2.9	99	135.6	1:1,370	80.3	1:811	58.9	1:595
Engineering & management services	87	1.7	121	158.8	1:1,312	66.8	1:552	47.2	1:390

**Table 7**

## Sorting from Base Document 2: A

Sorted by the ratio of fatalities to total injuries and illnesses: Aggregate for the years 1999, 2000 and 2001. Total number of injuries and illnesses are expressed in thousands.

	SIC Code	Incident Rate Total Cases	No. of Fatalities	Total No. of Injuries & Illnesses	Ratio of Fatalities to Total Injuries & Illnesses	Group
Agricultural production—crops	01	6.9	928	84.1	1:91	B
Coal mining	12	7.3	117	17.9	1:153	B
Oil & gas exploration	13	3.7	231	36.4	1:158	C
Water transportation	44	7.0	144	36.0	1:250	B
Agricultural services	07	7.0	568	189.7	1:334	B
Local & interurban passenger transit	41	9.0	266	101.0	1:380	A
Lumber & wood products mfg.	24	11.9	527	285.3	1:541	A
General building contractors	15	7.6	559	304.6	1:545	B
Transportation services	47	3.3	61	42.3	1:693	C
Membership organizations	86	3.0	90	64.6	1:718	C
Personal services	72	3.1	121	88.6	1:732	C
Business services	73	3.0	551	519.1	1:942	C
Educational services	82	3.0	113	113.0	1:1,000	C
Private industry		6.0	16,075	16,572.9	1:1,031	
Stone, clay & glass products	32	10.4	141	183.2	1:1,299	A
Engineering & management services	87	1.7	121	158.8	1:1,312	C
Communications utilities	48	2.9	99	135.6	1:1,370	C
Transportation by air	45	13.5	256	421.4	1:1,646	A
Wholesale trade: Nondurable goods	51	6.8	305	539.2	1:1,768	B
Primary metal industries	33	12.1	137	257.6	1:1,880	A
Food & kindred products mfg.	20	12.0	208	612.5	1:2,944	A
Industrial machinery & equipment mfg.	35	7.8	143	498.4	1:3,485	B
Fabricated metal products	34	11.9	143	542.1	1:3,791	A
Social services	83	5.9	81	385.1	1:4,754	B
Transportation equipment mfg.	37	13.3	150	743.7	1:4,958	A

eight industries with the most unfavorable ratios of fatalities to total injuries.

•Seven of the eight industries in Group C—those with the lowest incidence rates—have ratios of fatalities to total injuries that are ninth through seventeenth in this list of 24 industries.

Table 8 takes from Table 6 to show the ratio of

fatalities to LWDCs with DAFW. As stated earlier, the variations are great.

### Conclusion

These tables may produce several questions about the great variations in the severe injury data by industry. Having concluded this study, the author



will continue to propose that safety professionals should give more attention to severe injury potential.

Safety practitioners who want to use injury ratios should produce their own. In the process, they can establish for themselves the degree of accuracy of the resulting conclusions.

If such ratios are produced, they should encompass

a sufficient time span to give them a broad statistical base. This study originally covered only one year. Hoskins suggested that it be extended to three years.

Starting with the injury data that is typically compiled internally with respect to total injuries and illnesses, LWDC and LWDC with DAFW, it is a simple division process to produce ratios and percentages.

Similar computations can be made using BLS data for selected SIC codes and for data produced by trade groups if it is available.

Ratios of value can be produced from internally compiled incident data. Caution is again emphasized as those ratios are related to computations made from BLS data and to data published by trade groups. To highlight, it is repeated that the variations in the ratios for individual industry categories are so great that comparing any industry's ratios to a universally established ratio, such as the ratios for private industry as a whole, may result in conclusions of limited value. ■

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**Table 8**

### Sorting from Base Document 2: B

Sorted by the ratio of fatalities to LWDC with DAFW. Aggregate for the years 1999, 2000 and 2001.

	SIC Code	Incident Rate Total Cases	Ratio of Fatalities to LWDC with DAFW	Group
Agricultural production—crops	01	6.9	1:29	B
Oil & gas exploration	13	3.7	1:64	C
Coal mining	12	7.3	1:104	B
Water transportation	44	7.0	1:124	B
Agricultural services	07	7.0	1:129	B
Local & interurban passenger transit	41	9.0	1:150	A
Lumber & wood products mfg.	24	11.9	1:155	A
General building contractors	15	7.6	1:206	B
Membership organizations	86	3.0	1:214	C
Personal services	72	3.1	1:231	C
Transportation services	47	3.3	1:269	C
Educational services	82	3.0	1:276	C
Business services	73	3.0	1:290	C
Private industry		6.0	1:305	
Stone, clay & glass products	32	10.4	1:365	A
Engineering & management services	87	1.7	1:390	C
Primary metal industries	33	12.1	1:437	A
Communications utilities	48	2.9	1:595	C
Wholesale trade: Nondurable goods	51	6.8	1:622	B
Transportation by air	45	13.5	1:779	A
Industrial machinery & equipment mfg.	35	7.8	1:797	B
Transportation equipment mfg.	37	13.3	1:921	A
Food & kindred products mfg.	20	12.0	1:1,008	A
Fabricated metal products	34	11.9	1:1,041	A
Social services	83	5.9	1:1,559	B

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