

**Zeitschrift:** IABSE reports = Rapports AIPC = IVBH Berichte  
**Band:** 44 (1983)  
  
**Artikel:** Accidents in the construction industry and preventive measures  
**Autor:** Ito, Masato  
**DOI:** <https://doi.org/10.5169/seals-34074>

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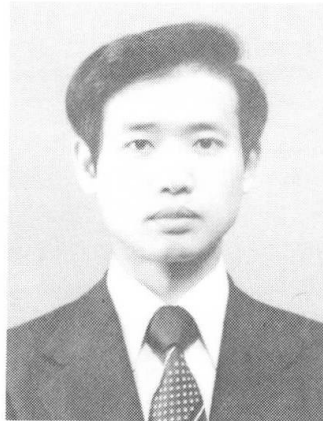
## Accidents in the Construction Industry and Preventive Measures

Prévention des accidents dans l'industrie de la construction et règlements de sécurité

Unfälle in der japanischen Bauindustrie und Massnahmen zu ihrer Verhütung

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### SUMMARY

This paper shows the occurrence of accidents in the construction industry. Graphs and tables show the trends of the number, frequency and severity of the workers dead and injured at construction work since 1958. The paper also shows the types of works and injuries as well as measures to prevent accident in the construction industry based on safety regulations and voluntary activities.

### RESUME

L'article présente le développement des accidents dans l'industrie de la construction japonaise. Des graphiques et des tabelles montrent l'évolution du nombre de travailleurs décédés et blessés dans l'industrie de la construction depuis 1958, selon le type de travail et le type d'accident. L'article montre des mesures de prévention des accidents dans l'industrie de la construction.

### ZUSAMMENFASSUNG

Dieser Bericht zeigt die Entwicklung der Unfallvorkommnisse in der japanischen Bauindustrie. Diagramme und Tabellen zeigen die Anzahl der getöteten und verletzten Arbeiter auf dem Bau seit dem Jahr 1958, nach Arbeitsgattung und Unfallart klassifiziert. Der Bericht zeigt schliesslich Massnahmen zur Unfallverhütung in der Bauindustrie.



## 1. Introduction

Recently, the occurrence of industrial accidents in the Japanese construction industry has decreased year by year due to the efforts made by parties concerned, but there still are more than 100,000 cases of serious injuries and a little over 1,200 cases of deaths. The rate of accidents is by far higher than in the manufacturing and other industries.

In order to find some way out of the present situation in which such large numbers of industrial accidents take place in the construction industry and give full play to the endeavors to prevent industrial accidents, it is necessary to develop a control system for each business in regard to occupational health and safety and to energetically step up the prevention of labor accidents on a voluntary basis.

Given this situation, the Government is striving to keep the Occupational Safety and Health Law and other laws and ordinances in perfect order for a further thoroughgoing enforcement of measures for the prevention of labor accidents in the construction industry. It is also evolving new comprehensive measures for a further promotion of voluntary labor accident prevention activities on the part of businesses.

## 2. Present Situation of Labor Accidents in Construction Industry

### 2.1 Trend in Deaths and Injuries

In Japan, about four million workers are placed on the payroll of the construction industry. Of them, about 240,000 workers suffer from industrial accidents (for which they take one or more days off) each year while they are engaged in construction projects.

Fig. 1 shows fluctuations in the numbers of deaths and injuries requiring four or more rest days in industrial accidents in all industry and the construction industry since 1973. This figure indicates that the number of labor accidents involving deaths and injuries in the construction industry stood at 112,185 in 1958. As it increased year by year, it reached a peak of 137,282. The number of labor accidents involving deaths reached a high of 2,652 in 1961. Presumably, the reason is that the number of workers increased and in this connection there was a rise in the occurrence of labor accidents as the number of construction projects began to increase all of a sudden in 1959 or so due to a high growth of the Japanese economy. Later, construction projects also increased in number. On the other hand, there was an increased awareness of the necessity of preventing industrial accidents and measures for the prevention of industrial accidents were energetically stepped up, with the result that there appeared signs of a drop in the occurrence of industrial accidents.

Particularly with the enactment of the Occupational Safety and Health Law in 1972 as a turning point, the measures for the prevention of industrial accidents at each establishment were conspicuously replenished and production actively came to a standstill as recession had crept in. Due partly to such reasons, there has been a sharp drop in the occurrence of labor accidents in the last several years.

In 1981, there were 1,173 industrial accidents involving deaths, down 55.8% from 1961 or 20 years ago. In the same year, however, there were 100,281 industrial accidents resulting in deaths and



injuries and requiring more than four rest days, down 27% from 1962. The occurrence of such industrial accidents has leveled off in the last 15 years. The construction industry accounts for 32.1% of the industrial accidents involving deaths in all industry and 40.3% of industrial accidents involving deaths and injuries.

## 2.2 Trend of Accident Frequency Rate

Fluctuations in the occurrence rates (rate per 1,000 workers a year and frequency rate) and in the severity rate are shown in Figs. 2 and 3. The rate per 1,000 workers a year is about 2.5 times, the frequency rate 1.4 times and the severity rate about 2.4 times as big as in all industry.

## 2.3 Industrial Accidents in Construction Projects

### 2.3.1 Industrial Accidents by Type of Construction Work

Of all labor accidents in construction projects, those which require four or more rest days take place to the tune of 100,000 cases a year. Such industrial accidents in 1970, 1975 and 1978 are compared in Table 1 by type of construction work.

Table 1 indicates fluctuations in the occurrence of industrial accidents by type of construction work. In other words, the number of industrial accidents in construction projects increased by 54% in 1978 but there were corresponding drops in the numbers of civil engineering and facilities construction projects. There was a marked increase in the number of wooden house construction and other civil engineering projects but a drop in that of road construction and machinery installation projects.

Industrial accidents involving only deaths are indicated in Table 2 by type of construction work. In the civil engineering sector, many industrial accidents involving deaths have occurred in road construction, water supply and drainage construction, land readjustment and other projects. In the building construction sector, they have frequently occurred in building (SRC and S) construction and wooden house construction projects. As regards the facilities construction sector, there are many such accidents in telecommunication projects.

### 2.3.2 Situation of Industrial Accidents by Type

Table 3 indicates the tendency of industrial accidents involving deaths by type of accident. In the construction industry, accidental falls in which workers fall to the ground, etc., while engaging in construction work at high places account for about one-third of all industrial accidents involving deaths. Then there are many accidents in which workers are run over or knocked down by dump trucks, minibuses, trains, etc., or which take place as a result of their spill (accidents by autos, etc.). Quite evident from this table are the facts that there are signs of a rise in the occurrence of accidents by bulldozers, shovels and other heavy machinery and that the number of accidents by landslides, cave-ins, etc., is on the downturn.

Such developments indicate that the number of accidents in which workers are knocked down or run over is on the up-swing as bulldozers, back hoe and other heavy machinery have been adopted

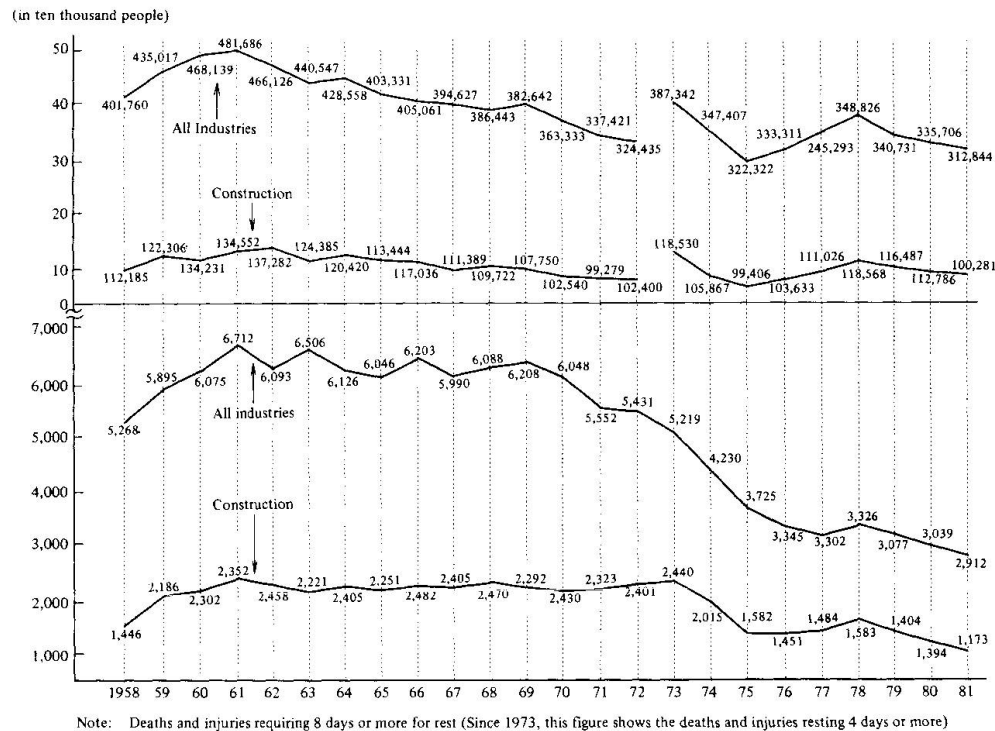


Fig. 1. Trend in Deaths and Injuries

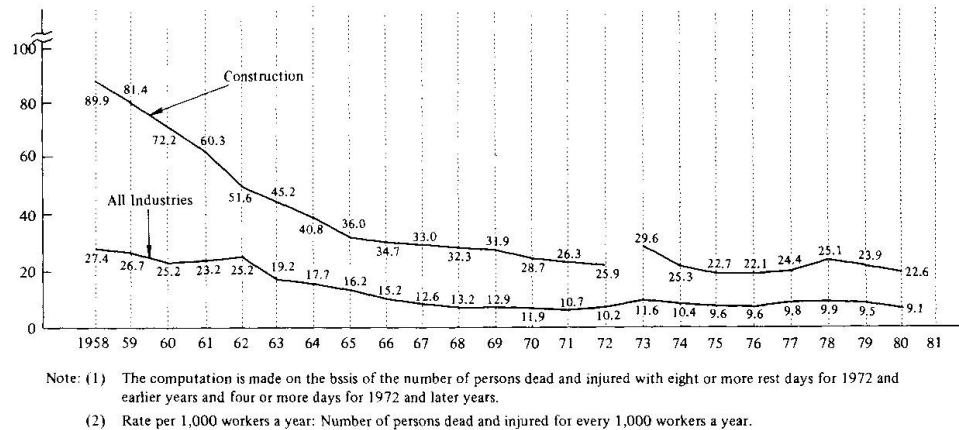
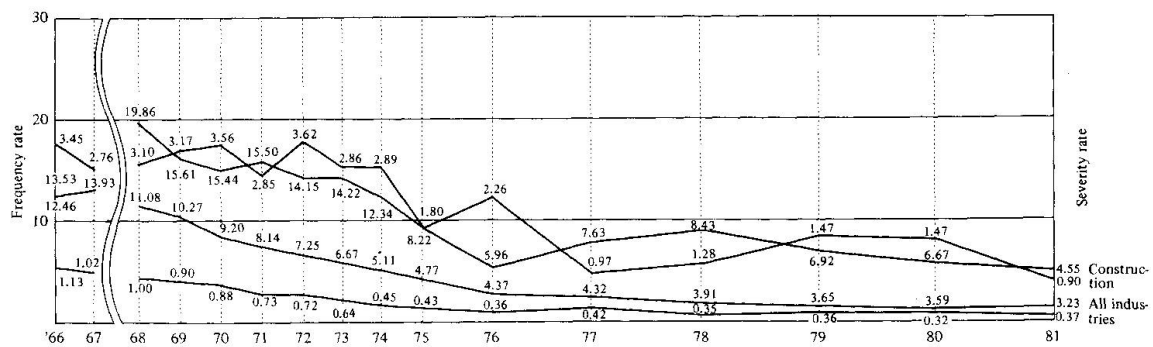


Fig. 2. Rate per 1,000 Workers a Year



Note: (1) This table refers to the rate of occurrence of death or injury hazards requiring leave of one or more days as investigated by the Statistical Information Department, Japanese Ministry of Labor, Office of the Minister on 15,000 business premises where 100 or more workers are employed for the two calendar years of 1980 and 1981.

Fig. 3. Fluctuations in Frequency and Severity Rates



even at construction sites medium and small in scale due to the progress made in the mechanization of construction work. On the other hand, the number of accidents by landslides, cave-ins, handling, transportation, etc., is on the downswing, as drilling work, handling of heavy equipment and other work which were manually done in the past have been mechanized, thus bringing about a drop in the manual handling of dangerous objects and working in drilled pits.

Incidentally, the occurrence of accidents involving deaths in 1981 is indicated in Table 4 by type of construction work and by type of accident.

### 2.3.3 Occurrence of Grave Accidents

The accident in which three or more workers suffer is defined as a grave accident by the Ministry of Labor and taken up as the subject of a special investigation and analysis. There have been signs of a drop in the occurrence of grave accidents, but the construction industry accounts for more than half of grave accidents in all industry each year. In the construction industry, it is highly likely that many workers are killed or injured at one time in accidents caused by landslides, cave-ins, collapses, explosions, etc.

The construction industry subjected to this investigation refers to work sites whose individual contract is worth 90 million yen or more, or whose accident insurance premium exceeds 0.6 million yen. However, machine equipment installation, electrical work and piping businesses are not included.

The frequency rate represents the number of labor accident casualties (deaths or injuries) per million working hours; that is a figure obtained by dividing the number of labor accident casualties during the investigation period by the total number of working hours for all the workers who were subjected to the same occupational hazard. The formula is as follows:

$$\text{Frequency rate} = \frac{\text{Deaths or injuries in occupational accidents}}{\text{Total working hours}} \times 1,000,000$$

The severity rate shows the magnitude of labor accident with lost work days per 1,000 working hours; that is, a figure obtained by dividing the total number of days lost due to occupational accidents by the total working hours of all workers who were subjected to the same occupational hazards during the investigation period. The formula is as follows:

$$\text{Severity rate} = \frac{\text{Lost work days}^*}{\text{Total working hours}} \times 1,000$$

\* Lost work days

(a) Deaths 7,500

(b) Injuries resulting in physical handicaps

Handicap rating	1-3	4	5	6	7	8	9	10	11	12	13	14
Work days lost	7,500	5,500	4,000	3,000	2,200	1,500	1,000	600	400	200	100	50

(c) Injuries causing no physical handicap

$$\text{Work days lost} = \text{leave of days} \times \frac{300}{365}$$



Table 1. Number of Workers Dead and Injured by Type of Construction Work

Type of Work		1970	1975	1978
Civil Engineering Construction Work	Dam	474 ( 0.47)	708 ( 0.71)	424 ( 0.36)
	Tunnel	2,146 ( 2.14)	2,531 ( 2.55)	1,744 ( 1.47)
	Subway	573 ( 0.57)	302 ( 0.30)	253 ( 0.21)
	Railroad	1,347 ( 1.34)	807 ( 0.81)	1,111 ( 0.94)
	Bridge	2,134 ( 2.13)	1,898 ( 1.91)	1,991 ( 1.68)
	Road	9,917 ( 9.89)	10,290 ( 10.35)	10,830 ( 9.13)
	River	4,755 ( 4.74)	5,237 ( 5.27)	5,258 ( 4.43)
	Land slide protection	1,975 ( 1.97)	2,167 ( 2.18)	2,266 ( 1.91)
	Land improvement	3,341 ( 3.33)	3,565 ( 3.59)	3,819 ( 3.22)
	Water supply & sewage			
	Harbour	13,113 ( 13.08)	15,328 ( 15.42)	17,850 ( 15.05)
	Others			
	Sub-total	39,775	42,833	45,546
Building Work	Building	22,075 ( 22.03)	16,849 ( 16.95)	25,218 ( 21.27)
	Wooden house	17,992 ( 17.95)	24,631 ( 24.78)	29,647 ( 25.00)
	Pipe arrangement etc.	2,572 ( 2.57)	2,031 ( 2.04)	2,693 ( 2.27)
	Others	5,699 ( 5.69)	4,689 ( 4.72)	6,528 ( 5.51)
	Sub-total	48,338	48,200	64,086
Equipment Work	Electric work	4,547 ( 4.54)	3,287 ( 3.31)	3,740 ( 3.15)
	Machinery	3,576 ( 3.57)	2,196 ( 2.20)	1,929 ( 1.63)
	Others	4,004 ( 3.99)	2,900 ( 2.91)	3,267 ( 2.77)
	Sub-total	12,127	8,373	8,936
Total		100,240 (100.00)	99,406 (100.00)	118,568 (100.00)

Table 2. Occurrence of Industrial Accidents Involving Deaths by Type of Construction Work and by Year

Type of work   <
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Table 3. Deaths by Type (Construction)

Type \ Year	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
Falling	741 (30.0)	738 (29.6)	770 (31.7)	703 (30.3)	675 (28.1)	691 (28.4)	647 (32.1)	487 (30.8)	496 (34.2)	497 (33.9)	495 (31.3)	517 (36.8)	517 (37.5)	425 (36.2)
Flying objects and breakdown	137 ( 5.5)	141 ( 5.7)	143 ( 5.7)	144 ( 6.2)	103 ( 4.3)	104 ( 4.3)	76 ( 3.8)	104 ( 6.6)	97 ( 6.7)	101 ( 6.9)	130 ( 8.2)	94 ( 6.7)	85 ( 6.2)	91 ( 7.8)
Cave-in and collapse	243 ( 9.8)	246 ( 9.9)	238 ( 9.8)	246 (10.6)	211 ( 8.8)	214 ( 8.8)	162 ( 8.0)	118 ( 7.5)	132 ( 9.1)	101 ( 6.9)	108 ( 6.8)	93 ( 6.6)	93 ( 6.8)	97 ( 8.3)
Machinery	Crane etc.	157 ( 6.4)	107 ( 4.3)	118 ( 4.9)	131 ( 5.6)	133 ( 5.5)	179 ( 7.3)	114 ( 5.7)	72 ( 5.8)	79 ( 5.4)	90 ( 6.2)	116 ( 7.3)	115 ( 8.2)	77 ( 6.6)
	Traffic	464 (18.9)	482 (19.3)	436 (17.9)	447 (19.2)	465 (19.4)	393 (16.1)	351 (17.4)	264 (16.7)	230 (15.9)	228 (15.6)	260 (16.4)	222 (15.8)	187 (15.9)
	Construction machine etc.	278 (11.3)	308 (12.4)	291 (12.0)	309 (13.5)	314 (13.1)	338 (13.8)	302 (15.0)	274 (17.3)	223 (15.4)	215 (14.7)	233 (14.7)	170 (12.1)	161 (13.7)
Electric shock	243 ( 9.8)	247 (10.0)	209 ( 8.6)	161 ( 6.9)	157 ( 6.5)	155 ( 6.4)	126 ( 6.3)	102 ( 6.4)	77 ( 5.3)	92 ( 6.3)	82 ( 5.2)	70 ( 5.0)	64 ( 4.7)	48 ( 4.1)
Explosion, fire							49 ( 2.4)	45 ( 2.8)	47 ( 3.2)	56 ( 3.8)	63 ( 4.0)	37 ( 2.7)	33 ( 2.4)	18 ( 1.5)
Handling etc.	53 ( 2.1)	18 ( 0.7)	41 ( 1.7)	48 ( 2.1)	48 ( 2.0)	89 ( 3.6)	30 ( 1.5)	33 ( 2.1)	18 ( 1.2)	25 ( 1.7)	29 ( 1.9)	25 ( 1.8)	30 ( 2.2)	10 ( 0.9)
Others	154 ( 6.2)	203 ( 8.1)	184 ( 7.5)	134 ( 5.8)	296 (12.3)	277 (11.3)	158 ( 7.8)	63 ( 4.0)	52 ( 3.6)	59 ( 4.0)	67 ( 4.2)	61 ( 4.3)	34 ( 2.5)	59 ( 5.0)
Total	2,470	2,492	2,430	2,323	2,402	2,440	2,015	1,582	1,451	1,464	1,583	1,404	1,374	1,173

Note: Explosion, fire is included in "others" until 1973.

Table 4. Deaths by Construction Work

Type of Work  Type of Accidents		Civil Engineering Construction Work													Building Work					Equipment Work				Unclassifiable	Total	Percentage (%)
		Dam	Tunnel	Subway	Railroad	Bridge	Road	River	Land slide protection	Land improvement	Water supply & sewage	Harbour	Others	Sub-total	Building	Wooden house	Pipe arrangement etc.	Others	Sub-total	Electric work	Machinery	Others	Sub-total			
Falling		6	2	4	1	8	19	4	9	9	9	2	10	83	124	95	21	18	258	33	25	22	80	4	425	36.2
Flying objects and collapse			2	1	1	6	4	7	5	3	4	4	6	43	18	12	1	2	33	9	2		11	4	91	7.8
Land slide and cave-in		1	6				28	4	10	12	23	2	5	91	2				2	2		2	4		97	8.3
Machinery	Crane etc.		2			2	2	8	8	3	5	6	3	39	10	1	2	5	18	5	11	4	20		77	6.6
	Traffic	4	2	1	9	3	54	12	2	14	12	1	14	128	14	12	4	2	32	12	1	5	18	9	187	15.9
	Construction machine	2	9		1	5	51	10	4	19	18	4	11	134	8	4			12	5	3	2	10	5	161	13.7
Electric shock					2						3		1	6	3	1	3	1	8	32	2		34		48	4.1
Explosion, fire			2				2	1						5	2		3		5			1	1	7	18	1.5
Others		3	1		1	1	6	5	2	2	4	6	7	38	8	4	2	1	15	4	7	4	15	1	69	5.9
Total		16	26	6	15	25	166	51	40	62	78	25	57	567	189	129	36	29	383	102	51	40	193	30	1,173	100.0





### 3. Overview of Legal Control and Measures

There is a need to come to grips with measures for the prevention of industrial accidents in a diversified manner. With this in mind, the Ministry of Labor has combined various systems with one another and systematized measures for the prevention of industrial accidents on the basis of the Occupational Safety and Health Law and its related laws and ordinances.

Table 5. Overview of Measures for Prevention of Industrial Accidents in Construction Industry

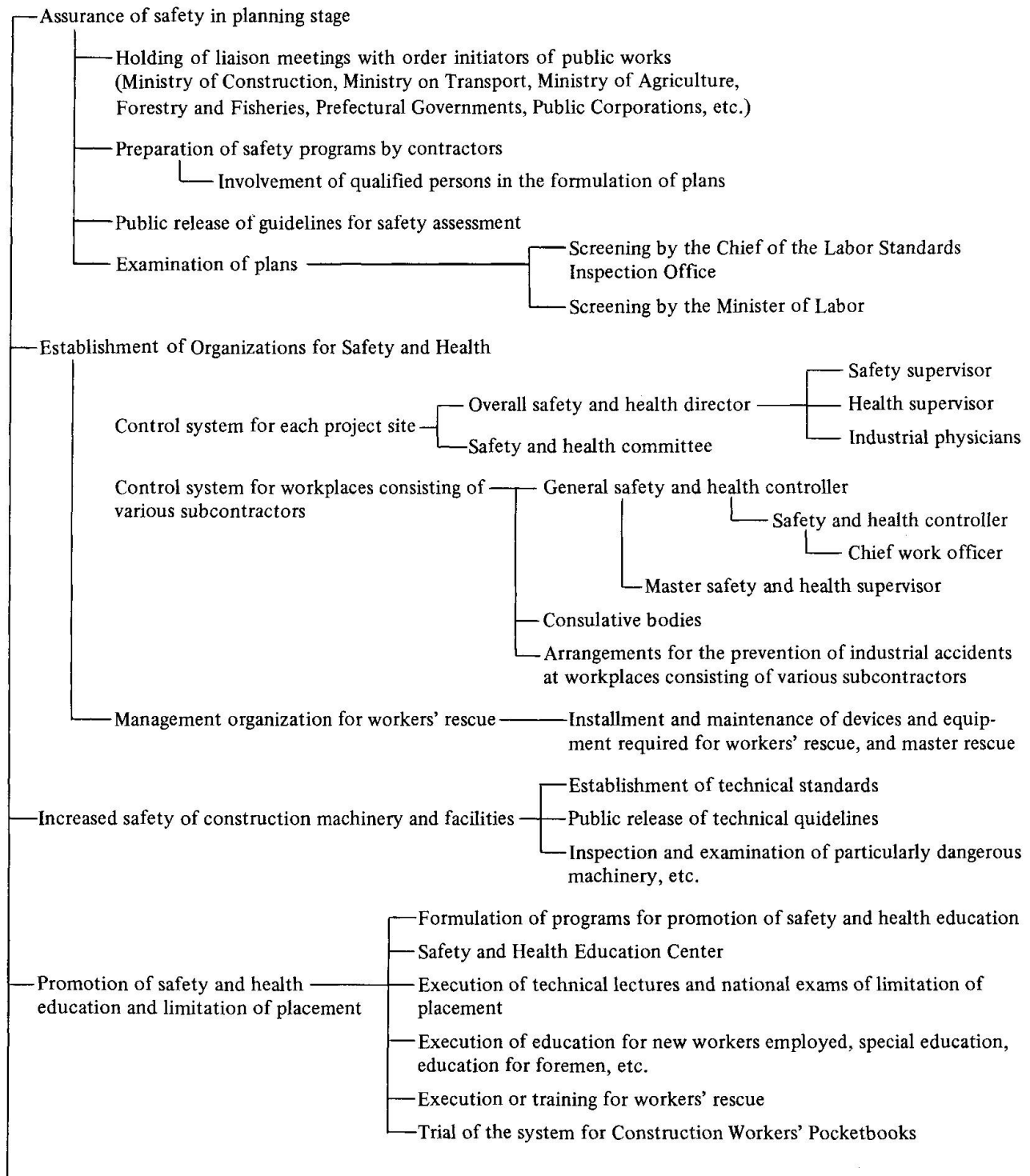




Table 5 (Cont'd)

Encouragement of voluntary activities for the prevention of labor accidents, assistance to small businesses, etc.	Activities of the Construction Industry Labor Accident Prevention Association
	Guidance and assistance to related organizations
	Activities of the Committee on Safety Measures for Construction of Wooden Houses
	Loans system for temporary materials of construction work
	Preparation of renovation plans and loans system
	Guidance and assistance in the execution of safety patrols
Development of research systems	Studies at the Research Institute of Industrial Safety (Ministry of Labor)
	Performance of consignment research

#### 4. Outline of the Industrial Safety and Health Law

Titles of chapters and sub-chapters of the Industrial Safety and Health Law are shown below.

##### General Provision

Object

Responsibilities of Employer

##### Organization for Safety and Health Management

General Safety and Health Director

Safety Supervisor

Health Supervisor

Industrial Physician

Operation Chief

Safety and Health Committee

##### Measures for Preventing Hazards and Health Impairment of Workers

Measures to be taken by Employer

##### Regulations concerning Machines and Harmful Substances

Restriction of Transfer

Examination

Periodical Voluntary Inspection

Prohibition of Manufacturing

Permission for Manufacturing

Labelling

Investigation of Toxicity of Chemical Substances

##### Measures in Placing Workers

Safety and Health Education

Limitation of Placement

##### Industrial Health Preservation

Working Environment Measurement

Medical Examination

Personal Health Record

Work Prohibition of the Sick



Limitation of Hours of Work  
Measures to Keep and Improve Health

License

License  
License Examination  
Skill Training Course

Safety and Health Improvement Programme

Direction for Preparation of Safety and Health Improvement Programme  
Safety and Health Consultation Industrial Safety Consultant  
Industrial Health Consultant

Inspection

Notification of Plan  
Labor Standards Inspection  
Expert Officer for Industrial Safety  
Expert Officer for Industrial Hygiene  
Medical Advisor for Industrial Health  
Complaint by Workers  
Order of Stopping Use  
Report

Penalty Rules