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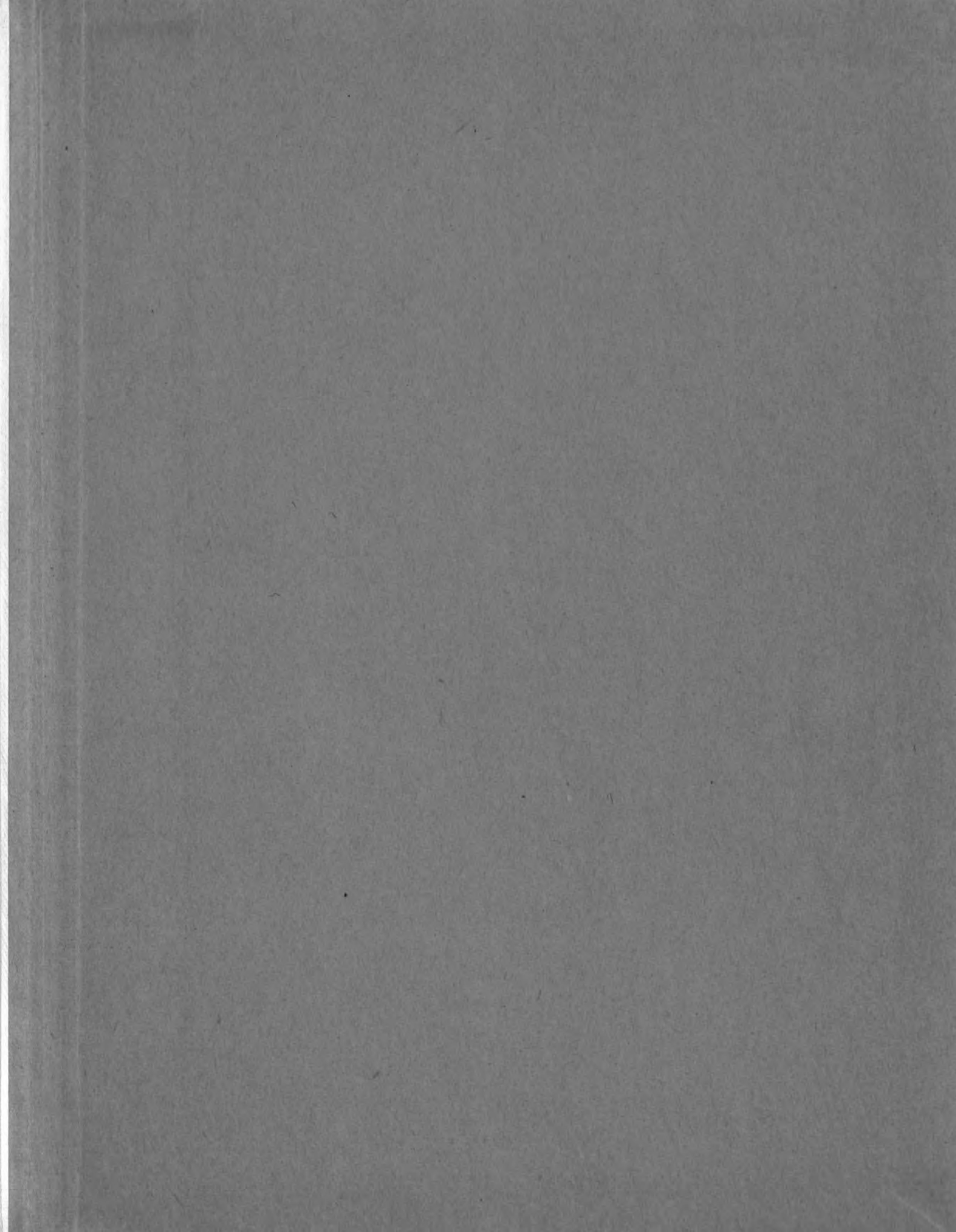
A SURVEY OF SAFETY WORK IN
THE CONSTRUCTION INDUSTRY

Thesis for the Degree of B. S.
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THESIS

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A Survey of Safety Work
in the
Construction Industry

A Thesis Submitted to

The Faculty of
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by

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There is nothing under God's Heaven that justifies
your creation or your citizenship but this gospel -
that the next greatest thing to creating a life is to
save a life.

- Charles E. Woodcock

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I. Introduction

James J. Davis, former Secretary of Labor, has pointed out the need for close attention to the accident situation in this country by giving us the following data:

(1) Every six minutes of the year there is a fatal accident in the United States

(2) There is a total of 99,000 deaths by accidents in the United States each year; 268 every 24 hours or 11 every 60 minutes of the day

(3) Every day in the year there are 52 deaths from accidents occurring in the industries of the country

(4) Every day 5,200 persons are injured in industry

(5) In industry there are 19,000 fatal and about 2½ million non-fatal accidents annually

(6) Each year approximately \$175,000,000 is lost in wages due to industrial accidents of one kind or another, and this does not include compensation for deaths and permanent disabilities.

From the above authentic data it should be universally agreed that safety demands the attention of our best minds and is especially important to the construction industry. The nature of construction work is in itself hazardous, but the rapidity with which men are shifted from one job to another at the completion of a project intensifies and aggravates its natural hazards.

Employers in heavy construction should know that a safe man is an economical man, and also should be vitally interested in the safety question from the humanitarian side and progress of work as well as economy.

We know that men do not want to get hurt, and when they are properly instructed in safety methods, fewer accidents will occur.

Accidents are very costly - compensation and medical costs, although large, are only a small percentage of total cost. In addition to lost wages, which amount to \$175,000,000, are the following which amount to a fabulous sum, and must be borne by the employer: (From an analysis of 5,000 accident reports by H. W. Hienrick, of the Travelers Insurance Company)

(1) Cost of lost time of injured employee where paid by employer although not due under compensation law

(2) Cost of time lost by other employees who stop work;

- a. out of curiosity
- b. out of sympathy
- c. to assist injured employee
- d. for other reasons

(3) Cost of time lost by foremen, supervisors, or other executives;

- a. assisting injured employee
- b. investigating cause of accident
- c. arranging for injured employee's production to be carried on by some other employee
- d. selecting, training, breaking in new employee

c. preparing state accident reports, or attending hearings before industrial commissioner

(4) Cost of time spent on case by first aid attendant and hospital department staff when time is not compensated by insurance

(5) Cost due to injury to machine, tools or other property, or spoilage of material

(6) Incidental cost due to interference with production, failure to fill orders on time, loss of bonuses, payments of bonuses and others similar causes.

(7) Cost to employer under employee welfare and benefit systems

(8) Cost to employer in continuing wages, in full, of the injured employee, although the services of the employee who is not yet fully recovered may be worth only 50 percent of their normal value

(9) Cost due to loss of profit on injured employee's productivity on an idle machine.

There is another side to safety and production - the human side. Every man prefers to work in a safe place, in a place where he feels the management has some regard for him as a human being. Accident prevention increases the contentment of the workers - their morale - thus reducing labor turnover and increasing production. Also the cooperative safety program - the safety

committees, management and men coming together in safety meetings, constant insistence that safety can be obtained only through cooperation between management and men - all these help to bring about, in the minds of management and men alike, a realization that they actually do have common interests to a much greater extent than they had before realized. It all combines to give added honor and dignity to the work.

Insurance companies for years have recognized the results of accident prevention methods, according to the Manual of Accident Prevention of the Associated General Contractors of America. These companies have encouraged this work by the "merit rating system" whereby employers are given a reduction in insurance rates when their records show a reduction in losses.

Although it is possible that actual premium rates per \$100 of payroll may increase because of the use of additional machinery and labor saving devices, concentrated production per man, amended benefits under compensation acts of different states, and increased costs of administering these acts, still the dollar cost of insurance per unit of construction cost of construction will not be high with proper accident prevention. However, in the absence of safety work, the costs of accidents will certainly become greater as time goes on, and the cost of construction

and price of bids will be greater.

Here is what the AGC manual has to say about accident prevention work: "On the normal basis of nine billion dollars of construction for one year in the United States, of which probably one-half, or four and one-half billion is payroll, the insurance cost to the industry for compensation and liability is about one hundred and ninety-four million dollars yearly. Added to this is a cost of at least another one hundred and ninety-four million for hidden losses, labor turnover, loss of wages, and interrupted production. If one-half of the accidents might be prevented by common-sense, practical educational means, as has been proven easily possible, a saving of no less than \$194,000,000 would result, in addition to the benefits derived from improved conditions, avoidance of suffering, and conserved man power. This is economically sound, morally right and comparatively easy.

"Accident prevention will return good dividends through many channels, and while the contractor is generally hard to sell, the practical benefits accruing to accident prevention and the humanitarian results through reduction of suffering, hardships and heartaches should be at once apparent. It is the duty of the contractor to have his employees instructed with respect to their work, and the neglect of this duty regarding accidents is chargeable against the industry when the accident occurs.

"From the beginning of time, contractors have through

lack of organization have been the football for almost every element in the industry. The opportunity is still with us to put our house in order through cooperation with our own Associated General Contractors of America."

II. History

That there is a definite and serious need for accident prevention work in all industry and especially the construction industry is an established fact among thinking executives. However, accident prevention is not something that was even considered at all prior to the year 1800, the year of the industrial revolution in America. Lets look to the history of safety work in order to better understand today's problems.

Soon after 1800, the effects of the Industrial Revolution that had started in England about 100 years earlier began to be felt in America. Steam engines were imported into Massachusetts and mills were constructed to manufacture cotton textiles. Workers were recruited from nearby farms, most of them women and children, many of the children being between the ages of six and ten years.

The introduction of the cotton gin early in the 1800's made a great contribution to the industrial revolution in America; but the transformation of the United States into an industrial nation took place largely after the Civil War.

For many years, working conditions in industry were deplorable. No attention at all was paid to the safety, health and welfare of the workers. Light, ventilation, and sanitation were not even considered. Each person worked from twelve to fourteen hours a day for six days a week. Deaths were frequent, and serious injuries were accepted by workers and management alike as a necessary by-product of each establishment, a price to be paid for industrial progress. Most employers believed that they owed no obligation whatsoever to an injured worker; they felt they were doing their duty if they gave a job as watchman to a man who had lost an arm or leg, or if they made a reasonably generous contribution to the funeral expenses of a worker who was killed in line of duty.

Since Massachusetts was the leading state from an industrial point of view, it is not surprising that it became the leader in industrial legislation. This was due in large part to the humanitarian and social arguments voiced by the clergy and the press. In 1867, this state passed a law providing for the services of factory inspectors, and two years later created the first bureau of labor statistics to study, among other things, the accident problem. Shortly after this, the same state established the ten-hour maximum working day for women. Then in 1877 the Massachusetts legislature voted to compel employers to safeguard hazardous machinery.

In 1885 Alabama passes an Employers' Liability Law, and Massachusetts did likewise in 1887. Although these laws were a long step in advance, since they made the employer liable for damages when workers were injured, they contained numerous loopholes. The most important of these were the so-called common law defences: contributory negligence, assumption of risk, and negligence of a fellow-worker. Since at least one of these was applicable to some extent in nearly every case of on-the-job injury, relatively few claimants were successful. Also since law suits were expensive, many did not press their claims. Those who did and who were successful usually had to pay a heavy proportion of their awards to meet the costs of the suit. Altogether, the financial burden on the employer was not enough to spur him on to prevent worker injuries.

As other states passed similar laws, insurance companies stepped into the picture by providing protection to employers against the heavy unforeseeable costs that might result from injuries to workers. Engineers were employed to inspect insured establishments primarily to evaluate the accident hazards to which the workers were exposed so that the necessary premium rates could be established. While studying operations in all sorts of industries and the conditions which caused accidents, these engineers learned various ways of reducing or

eliminating many of the hazards; so it was not long until their services in the field of accident prevention became at least as valuable as their work of inspection.

Safety leadership among industrialists was very weak at first. But in 1892 a safety department was organized at the Jolliet works of the Illinois Steel Company. The first safety order was the inspection of all engine fly wheels. Because of this early definite start, and because this program spread to many other mills, this mill has been often called "the birthplace of the American industrial accident prevention movement".

Meanwhile, dissatisfaction with the practical working of the employer liability laws grew. Organized labor, the clergy, and the press campaigned vigorously for corrective action. This action came in the form of workman's compensation legislation, whose basic principle is to require the employer to pay the injured worker's medical and hospital expenses plus compensation intended to furnish him (and his dependents) at least minimum subsistence during his period of disability. The question of "whose fault" is eliminated, the only requirement being that the injury shall arise out of employment. Also, under proper administration, the worker who has a legitimate claim need be put to no expense to secure the compensation due him. These laws, through making the worker injuries directly and immediately expensive to employers, have

done more to promote interest in safety than all other influences put together.

The first compensation law was enacted by Congress in 1908, but the benefits were meager and were limited to certain special classes of government workers. The oldest law of its kind still in force in the United States was passed by New Jersey in 1911. Other states followed this lead - seven in 1911, eleven in 1913, two in 1914, and ten in 1915. In 1943 workmen's compensation laws were in force in all states except Mississippi.

As workers came generally to understand their rights under these laws, and as enforcement grew in effectiveness, the number of claims increased rapidly, and the total cost to employers mounted to such substantial figures that some executives began to search for methods of preventing accidents, for it seemed that prevention would cost less than compensation.

In 1912 a small group of engineers met in Milwaukee under the auspices of the Association of Iron and Steel Electrical Engineers to Exchange ideas on such subjects as the costs of accidents, their causes, and their prevention. These early enthusiasts represented insurance companies, industrial corporations, and other interested groups. At this meeting it was agreed to organize a larger convention, which met in New York City the following year. Thus, in 1913, was organized the National Council for Industrial Safety, which for two years confined its

activities to the industrial accident problem. In 1915 the name of the organization was changed to National Safety Council, and its activities broadened to include the prevention of all accidents, regardless of location or activity, on the streets or highways, among school children, in the homes and so on. Under the Council's leadership, interest in safety is constantly growing.

There are today hundreds of other organizations providing specialized safety service in more or less limited fields. To prove that safety work is very much a living and integral part of modern industry, and life in general, here are listed a few of these organizations:

American Society of Safety Engineers
Associated General Contractors of America
American Standards Association
American Museum of Safety
American Public Health Association
American Gas Association
American Transit Association
American Petroleum Institute
American Railway Association
Automobile Manufacturers Association
American Industrial Hygiene Association
Fire Mutuals
National Conservation Bureau
National Bureau of Standards

National Electric Light Association
National Fire Protection Association
Portland Cement Association
State Safety Departments
United States Department Of Labor
United States Bureau of Mines
United States Public Health Service
Underwriters Laboratories, Inc.

Lack of space does not permit any more than a brief outline of the functions of these organizations, but complete information may be had by writing to any of them.

United States Bureau of Mines, Washington, D.C.

This bureau was organized in 1910 by the Department of the Interior. One of its major functions is to study the causes of accidents and ill health among miners and to promote the application of preventive measures. Its work has been and continues to be outstanding in its field. A very large part of the reduction of the accident rate in the mining industry is credited to the activities of the bureau. Its most spectacular work hasⁱⁿ that connected with coal mine explosions. It developed rescue methods and provided trained rescue crews with the specialized equipment necessary. It discovered the causes of mine explosions and proved them preventable. Its first aid courses have had a very important influence in promoting

interest in safety. Recently Congress added the duty of setting up and maintaining a coal mine inspection service, designed to be informational and preventive, in close cooperation with the mine inspection services of the various states.

Bureau of Labor Statistics, United States Department of Labor, Washington, D.C. Organized in 1913 in the Department of Labor, this bureau among other things collects, tabulates, and distributes statistical information about industrial accidents and health. Its services include issuing annual reports, and distributing these reports on industrial accidents, giving estimated totals and breakdowns by industries. It supplements these with reports on specific industries.

National Bureau of Standards, Washington, D. C. One function of this bureau, organized in 1910 in the Department of the Interior, is to create safety standards for various materials and equipment and to set up testing methods for determining their safety. The total volume of its accomplishment in the fire-prevention and accident prevention fields is large. It works very closely with the American Standards Association, itself sponsoring many of the codes.

Division of Labor Standards, United States Department of Labor, Washington, D. C. The objectives of this division, created in 1934, are to formulate labor standards

in labor legislation and labor law administration, and also to promote the importance of working conditions. Its safety activities as part of this general purpose include cooperating in the development and promotion of "American Standard" safety codes through ASA procedure, furnishing safety and health consulting services to labor administrative agencies and labor organizations, aiding states (which request it) to train and improve the competency of their safety-inspection personnel, and in general cooperating in the movement to reduce the toll of industrial injuries. The Division played a major part in the formation of the Federal Interdepartmental Safety Council formed to promote safety in federal employment. In 1940 the Division organized the Committee for the Conservation of Manpower in the Defense (later War) Industries, whose basic idea was to make available to plants lacking adequately trained safety personnel a safety consultant and advisory service through part-time use of safety engineers loaned for the purpose by their employers.

Every state has some department or bureau that has at least partial responsibility for the safety of wage earners in that state. Michigan, for example, has its Department of Labor and Industry, which furnished some of the statistics found elsewhere in this report.

The growing appreciation of the need for a high

standard of competence in safety-inspection services offers great hope in the struggle to reduce the tremendous waste that occupational accidents create.

III. Explanation of Safety Terms

Safety work has become in the present day a science, although not an exact science because of the presence of the human element. In order to provide an index to enable accident data to be compared, certain standard terms have been established. An explanation of these terms follows:

The accident frequency rate answers the question, "How often do accidents occur?" and it is defined as the number of disabling injuries per 1,000,000 man-hours worked. Expressed as a formula:

$$\text{Accident freq. rate} = \frac{\text{no. of disabling injuries} \times 1,000,000}{\text{total no. of man-hours worked}}$$

The accident severity rate answers the question, "How serious are the accidents?" and is defined as the number of days lost time per 1,000 man-hours worked:

$$\text{Accident severity rate} = \frac{\text{number of days lost} \times 1,000}{\text{total number of man-hours worked}}$$

You may ask, "Why use per 1,000,000 man-hours worked in calculating frequency rates, and per 1,000 man-hours worked in calculating severity rates?" The answer is

that by using two different bases, both rates are likely to fall between 1 and 99.

Following is an example of how these rates are computed. Say, for instance, that the Buildo Construction Company employed 80 men averaging 40 hours per week each, and in 6 months 4 workers were injured and jointly lost 103 days from work.

$$\text{Freq. rate} = \frac{4 \text{ injuries} \times 1,000,000 \text{ man-hours}}{80 \text{ workers} \times 40 \text{ hrs. a week} \times 26 \text{ weeks}} = 48 \cdot$$

$$\text{Severity rate} = \frac{103 \text{ days lost} \times 1,000 \text{ man-hours}}{80 \text{ workers} \times 40 \text{ hrs. a week} \times 26 \text{ wks.}} = 1.2$$

The American Standard Scale of time charges is:

Death.....	6000 days
Permanent total disability.....	6000
Arm, at or above elbow.....	4500
Arm below elbow.....	3600
Hand.....	3000
Thumb.....	600
Any one finger.....	300
Two fingers, same hand.....	750
Three fingers, same hand.....	1200
Four fingers, same hand.....	1800
Thumb and one finger, same hand.....	1200
Thumb and two fingers, same hand.....	1500
Thumb and three fingers, same hand.....	2000

Thumb and four fingers, same hand.....	2400
Leg, at or above knee.....	4500
Leg, below knee.....	3000
Foot.....	2400
Great toe or any two or more toes, same foot.....	300
Two great toes.....	600
One eye, loss of sight.....	1800
Both eyes, loss of sight.....	6000
One ear, loss of hearing.....	600
Both ears, loss of hearing.....	3000

The loss of 6000 days assigned to "death" in the above scale is not an arbitrary figure but is based on statistics furnished by the life insurance companies which showed that the average man killed in an occupational accident had a working life expectancy of 20 years, or 6000 days. Permanent total disability is given the same rating as death and lesser permanent disabilities are rated correspondingly less.

IV. Construction's Safety record

How does construction stand in accident prevention?
Does the industry need to be seriously concerned?

The answer is yes. Accident prevention in construction is a weak last. The safety record is terrible.

The above statement is based on facts taken from the 1947 edition of Accident Facts, a record published each

year by the National Safety Council. These records show that the accident frequency in construction is 23, compared to the national average of 14. Construction ranks 32nd out of 40 industries in accident frequency and 37th in accident severity.

In an accident prevention contest conducted by the Association of General Contractors, the accident frequency rate for building contractors was about 50. The 1947 average for the contest of the Constructors Association of Western Pennsylvania showed an accident frequency rate of about 40. A rate of 40 means a disabling injury every 25,000 man-hours, and 50 means one every 20,000 man-hours.

Here is a rather horrible but never-the-less accurate comparison that can be made. Remember how the Nazis treated hostages during the war, by executing every 10th man in a town to retaliate for the murder of an officer? With an accident frequency rate of 50 there is a lost time accident every 20,000 man-hours. 40 hours per week for 50 weeks per year equals 2000 man-hours per year per man. Or a frequency rate of 50 means every 10th man will have a lost time accident each year.

What does this mean? Here is some more data from Accident Facts, 1947 edition:

"In the construction industry during 1947, approximately 150,000 men were disabled, and about 4,600 were left with some form of permanent physical impairment, such as the loss, or permanent loss of use, of some part

or function of the body, and 2400 workers died."

Here is a quotation from the March 1948 issue of Construction, published by the United States Department of Labor, Bureau of Labor Statistics.

"The humanitarian and social implications presented by this large volume of injuries is immeasurable. From the economic viewpoint alone, however, it is clear that these injuries constitute a very large expense item which must be absorbed by the industry. The actual time lost by construction workers in 1947 because of work injuries experienced in that year is estimated as about 3,000,000 man-days.

"On the basis of current average hourly earnings for construction workers, this would represent a direct loss of \$46,200,000 in wages alone.

"The time lost in 1947, however, does not adequately measure the real loss resulting from these injuries. Many of the seriously injured workers will find that their earning ability will be reduced for the remainder of their lives, and for those who were killed the loss is equivalent to their entire expected earnings during the years to come when they would have been working if their careers had not been cut short by premature death. If additional allowance is made for the future effects of the deaths and permanent impairments included in the total, the economic time loss chargeable to the injuries

experienced in 1947 would amount to about 24,100,000 man-days. At current earning levels this would represent a loss of \$337,000,000 in present and future earnings, all of which must be absorbed by the employers, the workers, their dependents, and the consumers.

Historically the construction industry has had a high injury record.

It should be remembered that the above figures are gathered from members of such organizations as the National Safety Council and the Associated General Contractors, and that these firms are among the best in the industry. It is obvious that the records which we don't get - those firms too uninterested or too ignorant to secure the figures - must be far worse.

Yes, the construction industry has good reason to be concerned about its record in accident prevention.

V. Reasons for Bad Record in Construction

N. B. O'Connell, General Superintendent, Turner Construction Company, Boston, Massachusetts, a man who really knows construction, has this to say about the construction industry:

"The construction of a building is one series of emergencies. This was the favorite observation of the late Oswald L. Merkt of a well known New York engineering firm". Webster defines an emergency as "an unforeseen

condition requiring immediate action". Why do so many of these unforeseen conditions arise in the business? Perhaps the nature of the work has something to do with it. Lets take a look at it.

The architect and the engineer with a knowledge of materials, their uses and strengths lay out on paper and in words a structure which, if they have not erred, will stand sound, plumb, and stable when finished, despite winds, snow and ice and even cyclones and earthquakes. It is up to the builders to take the materials prescribed and put them together in the manner indicated.

It is the putting together of these parts that gives rise to troubles and emergencies.

In short the builder works for the greater part of his job with things in a temporary state. He is never quite sure of the forces with which he has to contend, and he is never sure that some unforeseen influence will not make itself felt. He is also never sure that he has properly evaluated their potentialities.

The builder for the greater part of the work is working in the open and is subject to the caprices and hardships of weather. Rain has undermined shores, caved in excavations, thrown undue stresses into braces and built up pressures never expected. Snow, ice and sleet have overloaded temporary structures, caused all sorts of slips and falls, and have even broken down love electric lines.

Winds have blown all kinds of tools and materials from buildings, caused canvases to blow against sides of sal-amanders, with consequent fire damage, and even caused men to be blown from the sides of structures.

Much of the work is carried out under poor lighting conditions. In spite of floodlights and temporary lighting systems, it seems impossible to keep a building under construction properly illuminated in all places.

It is for the most part a rough business. Much of the work is hard laborious bull-work. Many of our men are unskilled and many of the skilled men have grown old. Most of the work is exhausting, and fatigue is no respecter of safety posters and accident slogans. Materials, particularly lumber, are inferior in quality today. Boards are full of knots, and many a man has broken a leg or cracked his skull because he placed too much faith in a 2 x 9.

In view of these conditions, it is not hard to understand that the building industry rates very low from a safety angle.

But the United States Department of Labor adds to this with: "A high degree of hazard is admittedly present in construction work. Most construction hazards can be overcome, however, through application of safety principles. Fundamentally, the accident record of the construction industry is more indicative of inattention to

to safety principles than of the inherent hazards of the work".

VI. Proven Results of Accident Prevention

What exactly can be accomplished by the faithful and never-ending use of an intelligent accident prevention program?

Lets take a look at the du Pont Company which has one of the best programs in existence. From Accident Facts, the best no-injury record in the construction field was on one of their jobs at Belle, West Virginia, with 3,582,134 man-hours worked without a single accident that involved a disabling injury, and we find this same company holds the record in the textile industry, the chemical industry, and iron and steel products. This record is all because du Pont has a safety program, they practice it, and make their contractors practice it.

Again from the publication Construction of the United States Department of Labor: (after stating that the poor accident record in the construction industry is due to inattention to safety principles) "Evidence to support this conclusion is apparent in a comparison between the injury frequency rates of private contractors engaged in work for the Corps of Engineers of the United States Army and of those engaged in non-federal work. The standard contract for work under the Corps of Engineers specifies

that safety supervision must be provided and the specifications for the work outline basic measures for controlling known accident hazards. Enforcement of these provisions by inspectors of the construction forces of the Corps of Engineers has consistently resulted in much lower injury-frequency rates for work under their jurisdiction than has prevailed in other construction work."

The figures show that work supervised by the Corps of Engineers has consistently been from two and one-half to three and one-half times better in accident frequency.

Mervyn G. Gaskin, President, Taylor and Gaskin, Detroit, tells us in a speech made at a meeting of the AGC in Lansing on May 12, 1949, how to reduce compensation rates and in turn lower prices by putting an accident prevention program in force. He said, "Why a safety program? Several years ago, we of the Steel and Metal Erectors Association of Michigan, of which I was president, were alarmed at our compensation insurance rates, and the frequency and severity of our accidents. Our company was greatly interested as we had to pay a rate set up by the Compensation Bureau, which, as you know, sets a rate in accordance with the experience rating of our industry in our state.

"In 1943 the bureau rate for structural steel erection was \$31.57 per \$100 of payroll. Our company had a debit rating of 14 percent so our rate was \$36. Some of

our competitors, who were self-assured, did not pay these rates. They had definite safety programs and safety rules and regulations. They were using in that year a rate of approximately seven dollars against our \$36 per \$100 payroll, an advantage of \$29 per \$100 over us. When overhead and profit were added it meant a difference on the average of five dollars per ton."

He goes on to say that his company could not compete with them. The Steel and Metal Erectors organized, through the Detroit Industrial Safety Council, a safety program, and the monetary results have been remarkable. The compensation rates for riveted steel erection have decreased in the state of Michigan from \$31.57 in 1943 to \$12.11 this year in which the reduction was the maximum allowable for one year, 25 percent. In other steel erection they have gone from \$15.62 in 1943 to \$4.92 this year, and it is believed these rates will keep going down, as they are predicted on 1944 to 1946 experience.

Mr. Gaskin says that "the remarkable feature of these statistics is shown by the fact that in 1940 our total payroll was \$166,400 with five serious accidents, 39 non-serious, with total losses of \$46,461 as against 1946, when we had a payroll of \$980,000, one serious loss, 32 non-serious and total losses of \$38,683, a 600 percent increase in payroll and 20 percent reduction in losses. Remember, this is the worst portion of our industry, as the best employers are self-assured, and their payrolls and accidents are not included.

"Our company had a five per cent credit on base rate of \$28.75 in 1944, and this year we have a credit of 42.1 per cent on a still lower base rate of \$12.11, or a net rate of \$7.01 for steel erection against \$36 in 1943, a saving on every \$100 of payroll of \$29. In 1947 we had a refund of \$16,400, and in 1948 a refund of \$18,700. The reduction in compensation rates for steel erection means a savings to our industry in Michigan on a payroll of approximately \$3,000,000 of \$583,800. This is part of what we have accomplished through our program in a period of four years."

VII. Who is Responsible for the Safety Record?

Some people place all the blame for the industry's safety record on top management. Others place it at the supervisors level. Many say the workman himself is the one to blame. The answer is that all the above are to blame, plus other groups. All people connected with the industry have to play their part and the responsibility is allotted among them, as Gerard O. Griffin, Safety Director, Dravo Corporation, Pittsburg, Outlines in the November, 1948 Safety News.

No. 1. The Owners. The principals in the project, either through their own designers or through consulting engineers have a great effect on the safety or lack of it in the construction of the project. For instance, there is the case of the water tunnel where to save money on shaft sinking, much of the tunnel was driven on

a two per cent plus grade. Runaway trains killed several men. This was in addition to driving down hill. Another rather ridiculous example, which fortunately was caught before it got beyond the blueprint stage, came from the office of a firm of then famous consulting engineers. A penstock was to be tied into a power tunnel by concretizing 8 or 10 thirty foot lengths of the penstock pipe into the tunnel. As originally designed the tunnel was widened out at each joint to provide a place for the riveter to stand and drive rivets to join the pipe. However, they overlooked providing a path for the riveter to emerge after closing up the joint. This, of course, was later corrected. You can see from these examples what is meant by owner's responsibility. The designers for the owners have a particular responsibility when the owners are the public as in municipal, state, or federal projects.

No. 2. The Contractors or Management. Management in this case refers to the management of the contracting company or the company doing the work. This includes the heads of the firm, the chief engineer, all estimators, the general superintendent and the mechanical superintendent. (The last is in a position to make or break a company by the condition of the equipment he sends into the field) It should be an established fact that the estimator allow a reasonable amount in the estimate of each job for safety. It is naturally assumed that all state regulations must

be complied with, and a far-sighted outfit will set aside funds beyond the legal requirements.

The man who can do the most to prevent accidents in construction is the head of the contracting firm. He doesn't need to be a safety engineer; he merely needs to use the weight of his position to demand maximum performance in safety. There may be construction companies where a top notch safety engineer can drag his company's record up only with passive assistance from an uncooperative chief, but not probably. The boss must demand it and be willing to invest money for the savings he later gets by spending reasonable amounts for safety.

In the foregoing, the contractor has been considered as a single unit responsible only to principal. When there are several contractors, such as a general contractor and several subcontractors, the relationship becomes more complicated. However these complications as far as accident prevention is concerned is more fancied than real. The proper legal form should be written into the subcontract. The Dravo Corporation uses a good, simple form:

"You shall at all times during your performance hereunder require your employees to abide by the same or not less stringent safety rules and regulations that employees of Dravo Corporation working on the same job site are required to abide by; and you shall furnish your employees with the same or equally effective safety devices that are furnished by Dravo Corporation to its

employees on the same job site."

After that is a matter of reasonableness and co-operation between the superintendents or the general contractor and the subcontractor.

No. 3. The Supervision. Third is the responsibility of the supervision and by this is meant field supervision which should start with the job superintendent and include all levels of supervision.

The job superintendent is to the job what the president is to the contracting company. He can demand and get safety on his job, subject to some adverse reactions by not fixing up physical hazards. The superintendent can do more by personal contact with his assistants and general foremen than all the safety engineers in the world with their meetings.

One can't tell the superintendent how to do these things, but they must be done promptly. If the superintendent has made up his mind on a certain safety precaution and knows its right, he shouldn't wait till the end of the week or quitting time or even lunch time to put it into effect. If he waits, something like this might happen. On one of Dravo's jobs, the shift boss on a swing shift on a shaft job had a very poor accident record. He had been instructed and re-instructed and warned but with no results. There was a conference of the safety engineer and general superintendent. It was decided he was an unsafe supervisor and must go. Then the general

superintendent looked up the schedule and found the shaft would finish sinking in three and one-half weeks. So the matter was reconsidered, on the basis that a new shift boss might cause new accidents during that short period due to unfamiliarity with the work. The superintendent and safety engineer were both going to speak to him. Before the week was out this shift boss was killed, and a man in the gang suffered a fractured leg that disabled him for four years. The shift boss violated orders and had the safety miner-signal man mucking instead of confining him to his regular job. So because these supervisors did not "do it now" there was a widow made and a boy laid up for four years.

The superintendent generally designs the accident procedure for the job. He can eliminate 60 per cent of the construction accidents which are partially caused by incomplete operating procedures. (That only means they didn't think the job through on paper to forestall the operating hazards.) The best method is to design the job methods on paper by steps with due regard to elimination of hazards at each step.

No. 4. The Union Leaders. They are the fourth responsible group. We need more union statesmen and fewer union politicians. There is undoubtedly as high a percentage of statesmen among union leaders as there are among our political leaders; we could use many more of them. A union leader should have the intelligence and

courage to explain to a querulous brother whose hard hat doesn't fit right that he shouldn't pull the job or have the brothers refuse to wear hard hats just because he happened to get one that didn't fit or he happens to have a head that is a little difficult to fit. Hard hats do stop injuries. There are many cases where men's lives have been saved because they protect against falling objects, and the head is high on the rate list of injuries.

Union foremen should take some responsibility for safety. They are too often unwilling to eliminate from their gangs men who through bad health or incompetence are a hazard to themselves and others. Actually we aren't doing a man a favor by keeping him on a job he can't do and where he is liable to be injured or killed. Also bad is the attitude of certain locals and local officials against medical examinations. Construction is a virile business and needs men who are physically sound or with only slight defects. Its too bad for those who can't qualify, but they would surly be better off alive and well in some sedentary occupation than dead or hospitalized construction men.

No. 5. The Workmen themselves. They are the men who get hurt and take the brunt of all this, and they have a responsibility to themselves and their fellow workmen. The obstacle in making men safe workmen is "time". The record in the third year of any job big enough to last three years is pretty good. The chief

problem is to influence men's thinking and get them "construction wise" and "safety conscious" fast. Some outfits have huddle meetings either fifteen minutes every morning or two on Mondays or two or three minutes each morning when actual safe practices on the job to be undertaken are discussed.

VIII. The Human Side of Safety

Safety cannot be sold by merely thinking up a nice slogan and by putting up posters on the job site. These things have their place, but cannot alone do the job.

The first step is to sell management on safety 100 per cent. Management must not only know safety practices and all phases of them but they must also become expert in the one problem which is common to every serious accident. There is always the man in the picture.

One of the greatest hazards to safety is haphazard supervision. A great deal has been taken from the hands of the foreman but he still has one of the toughest jobs in the world - the job of human relations.

How many foremen, supervisors or even executives have a thorough grounding in the principles of scientific selection and placement of workers or the proper methods of induction and training?

"Here is the old problem, as old as history itself", says Dr. J. L. Rosenstien, Consulting Psychologist and Associate Professor, Loyola University, Chicago. "Responsibility without proper background for dealing with responsibility. In my opinion, the great hazards in industry

are not with employees or workers alone. One of the great hazards is haphazard supervision."

Dr. Rosenstien says that the supervisor is a normal person who worries and has his own problems and troubles. He says they also have a sense of insecurity, subconsciously or consciously, or a sense of inadequacy. This is explained by the fact that things have changed in the past 25 years. About 25 years ago the average worker had four, five, six, or maybe even eight years of schooling. It was a rare one who ever went to high school. Today they are fast becoming a 100 per cent high school educated group.

Moreover, they are learning to read and listen. They are smarter and wiser and better educated and more intelligent than the ones who started to work from school 25 years ago. The present supervisor cannot deal with these people by the old rule of the thumb any longer. They are analyzing, not just accepting. They are thinking, not just passively receiving. They are taking the boss apart every minute of the day when he is handing out instructions or giving orders or directing them.

There is one thing they cannot take away from the foreman. They can take selection, hiring and firing, and planning out of his hands. They can take grievances and discipline and so on out of his hands because of contracts. But he still has the most important job in the world - that of dealing in human relations. That is his function and will more and more become his function. He is becoming

an expert on human relations or he is a poor supervisor.

Supervisors, to be good supervisors, must think bigger and have bigger ideas and can't do so with the same old background. You can't think big with a narrow background.

If a supervisor is going to teach men individually he must teach them with new methods. He can't push them around anymore and tell that the first man who gets hurt will be fired. No, he is a human relations man and must teach them safe practices.

Safety is a thing that must be taught individually. Lets look at an example of a parallel situation. When people come and ask for a contribution to an organization like the Red Cross or Community Chest, even though you know they are worth while causes, money is parted with somewhat reluctantly. This is because the appeal is a general one. The appeal just doesn't reach you. Its meant for every one, but no one in particular.

But if someone were to say "Bill, we want \$20 from you. There's a kid down the street that can't walk - she needs a pair of braces. Her family is poor and her mother is out every day trying to support her. Tony and Dick and George and I are going to contribute \$20 apiece to buy that kid a pair of braces, and when you come down and see when she puts on those braces and can stand for the first time it will be worth the twenty bucks."

So you say twenty bucks is a lot of money and you can't afford it, but he has reached your heart and not your wallet. You won't say you can't do it, and you'll

give it. This is the personal appeal, and it reaches us all.

What about safety? The program should not be general but should be meant for each man himself directly and specifically. Each man should feel that it is for him alone, and not for five or six other men.

The General Motors Corporation found they cannot get enough people to talk safety to all the men individually, and never could have enough men to get around to all the men. So they used this idea; every supervisor, every single day, without fail must talk to two people individually about safety. He must keep a record of the person to whom he has talked and what he has talked about. It would not have to be much - maybe a minute or two, maybe five minutes or maybe a half hour if necessary.

They do not have any big meetings, no general topics. It is strictly personal, and they get real teamwork from that type of individual program. Just as on the football team everybody is taught the general rules of football, but in addition to the general principles, the line men are taught line football, the kickers are taught about kicking, the passers are taught about passing, and the backfield men are taught about running and carrying the ball. In the same way the continuing and abiding principles of safety should be taught to everybody.

But everybody should be taught. You should talk to every man and educate and train him in terms of safety as

it relates to him - safety on his specific job, safety on his specific operation, safety as it applies to him. You should know what happens when you get a crowd together - those in it can be rowdy and hard to handle. Yet if you take any member of that crowd and pull him over and talk to him, you cannot believe he is part of that crowd. He is a totally different person. You are reaching him in person - in his heart and mind. Teach safety in groups, but teach men individually.

Management has only one prerogative and only one abiding principle for existence and function, and that is to so operate a business which has been entrusted to management by the owners or stockholders so that the greatest profit possible accrues to the owners of the business. In order to live up to that prerogative it is management's duty to select and train employees properly. It is management's duty to analyze every rule and policy and study the effect they will have on the feelings and attitudes of every worker.

Management has always used special incentive plans by which a share of additional profit from extra employee effort has returned to the worker. That is the basic principle of the incentive plan. It is, therefore, management's prerogative to consider a safety incentive plan in which a portion of all the money saved as a result of accident reduction might be returned to the worker.

Management should realize that safety is a monetary concern to the stockholders, but that it is of more serious concern to the worker. It concerns his life, his home, and his whole future. Management should recognize that safety is a worker's program and should not be a management program in which workers are asked or begged or cajoled or threatened or forced to cooperate. It is and must be a worker's program in which management will cooperate by offering complete financial and technical help. Safety is a worker's problem financially, emotionally, physically, and socially. It is management's problem only financially.

Management must sell its safety programs to the worker. Since he is a special type of customer for a special type of product, a special and separate and distinct sales department, separate and distinct from personnel and labor relations must be established to sell him.

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Suggestion for Continuing Thesis

To compensate for the short eight weeks of this Spring Term, 1949, the following is suggested to continue this thesis; a study of several local contractors to determine their attitude toward accident prevention work and, if any, their actual programs and results of such programs.

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