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BUILDING SUPERINTENDENCE

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A Thesis

by

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BUILDING SUPERINTENDENCE.

The direction of Building operations is one of the main features in the erection of the modern fireproof steel and concrete building. What is to be said concerning the large modern buildings of today will apply equally well on all structures.

In the large city the erection of skyscrapers involves many problems for the superintendent of construction. In the following paragraphs some of these problems will be set forth as well as the qualifications of a good superintendent and some of the more important things he should know.

The superintendent of a building has charge of the erection of the building complete. He is employed by the contractor and is the medium between the owner, architect and the contractor.

The qualifications of a construction superintendent are many. Some are hard to define, others can be stated definitely. They are, a good business head, practical engineering sense, quick decision, diplomacy, character, address, observation, loyalty, responsibility and persistence -- in brief the qualifications of a managing executive.

Construction is constantly calling for business

judgment. To determine whether a certain action or an alternative, will pay best requires keen business instinct. Planning not only how to construct but how to construct in the quickest and cheapest way depends on practical engineering ability. Both business and engineering problems often call for quick decision and when emergencies arise prompt action only may avert disaster. It is the business of the superintendent to get along with the men who work for him, and for whom he works. It costs money to be at variance.

In the end, however, there must be more than technical and business qualifications. A truly successful superintendent must be a man of good habits, of good moral character and have high ideals. He must realize that honesty is not only the best policy but is right, and it pays to have a reputation of doing honest work. The old idea that a contractor in order to be successful must be known as a good fellow inclined to drink and do other things that he should not, in order to entertain the engineers and others, is obsolete. Any amount of drinking with a man or entertaining him will not help in attaining success; but on the contrary, may have just the opposite effect.

A good address is a valuable asset. While appearances are only on the surface sometimes the first impression made by outward appearance is of vital importance. If practicable the ability to express one's ideas clearly and forcibly in good language is invaluable. Also to be able to talk convincingly

when on your foot. The ability to go on a job and take it all in is also important. The habit of observation should be cultivated, as it is very necessary in the supervision of construction work. Loyalty to the employer is of course essential. If one is not in sympathy with the people he works for, he should seek a job somewhere else. The superintendent should be constantly striving to widen his acquaintance with engineers, contractors and others with whom his Company may later have business relations. He must always keep his eyes open to see how the other fellow does his work, ever ready to select better methods than those he is using. In doing this he broadens his viewpoint and becomes a better engineer.

Two qualifications which are probably the most important are, the first is a willingness to assume responsibility. It is far better to do something and get the work completed even though it is a longer and harder way, than to do nothing. The man who is always waiting for some one to tell him what to do and how to do it, does not progress very fast. Take responsibility and put all there is in you to do right what you have assumed to do. The other qualification is "stick-to-itiveness". The quitter should never enter the contracting game for there is no place for him in the business. What is wanted is the man who does the thing he starts out to do in spite of seemingly unsurmountable difficulties; who does not know when he is beaten; who does not know how to quit. If there is a quitting streak in a man he should never start in a career

leading to that of a contractor's superintendent.

The training of a superintendent is for the main part by experience. A college education is desirable, though not necessary. There are plenty of good men who had no more than a common or high school education. However, these men did not stop studying because they had no chance to go to college, but they made the most of their opportunities and grasped every chance for new ideas and advancement. The college man too has a hard road before him if he gets the idea he has his position cinched because he has a degree. A construction superintendent's main store of knowledge is from experience and observation.

It seems to be the opinion of most construction firms that the best way to train a man is inside the organization, from the bottom up. Thus they become familiar with the duties of the men in the various steps of progress upward; they become saturated with the ideals of the organization; they become familiar with its particular methods of handling work and its system of cost records, and they get to know the men of the organization.

A good construction superintendent not only knows how to direct operations in the field, but he has to be able to estimate quantities of materials, help make plans and assist in calculating the cost of an operation in order that the firm may bid on a job.

As soon as it is decided to make a bid for any construction operation, a superintendent is tentatively assigned.

His first task is to make a field study and in this he is usually assisted by others of the general organization of the firm, who can bring experience and skill to the consideration of the various problems. The site of the work is carefully investigated in detail and methods of planning and handling the work are studied. Available local supplies of building and other material are investigated and then the possibilities of outside material supply and delivery are comparatively studied. Local labor supply and wages, local markets and prices of materials and supplies, local transportation conditions by road and rail are ascertained. Then the site is studied very carefully to determine plant lay-out and a plan of work.

Following the field study a cost estimate in detail is undertaken -- each item of work is considered and its cost, including a proper proportion of overhead, is estimated. Then there is a conference of executives, superintendents, engineers and others of the organizations in which each item of the estimate is then drafted. The margin of profit desired is added and the bid is formulated and presented.

Thus when a contract has been secured it will be observed the superintendent has intimate knowledge of every consideration represented by the bidding prices and he proceeds to organize his operations with foreknowledge. The main items he has to consider are personnel, plant, progress, records and direction of work.

In picking the field organization the superintendent

first, so far as possible, selects foremen, clerks, timekeepers, etc., from within the organization and second, he should choose men having particular experience in the kind of construction undertaken. If he can, he gets his machine operators and skilled workmen from the same service. In brief, men trained inside the organization are utilized to the greatest extent practicable.

It is easy to see why men with the organization are desirable, the superintendent knows them, their abilities, initiative, and what they are capable of doing. In picking his men the superintendent should choose honest, straightforward, capable men, who have a reputation for doing things. One thing a superintendent must be able to do is to depend on his men directly responsible to him. On a large job there are too many major duties of the superintendent, to be hampered by men under him who do not understand what they are doing, or how to do a thing. If he has capable men working for him, frequent inspection trips is all that is necessary.

With the nucleus of his organization, the superintendent gets into the field, picks his office site, puts things into shape, builds camps and storehouses, if necessary, and gets the plant and materials coming to the job. Generally in preparing the bidding prices, the plant units and their arrangement have been determined so that the size of units is not a problem at this stage of the work. The field task is assembly. Units in stock are utilized first and new units bought when needed. Plant lay-out

and assembly are most carefully planned as in these days of machine operations the success of the work depends largely on equipment efficiency and plant arrangement.

The big duty of the superintendent is to get his organization into shape and keep the work lined up. Among his aides are progress schedules and performance and cost records. As soon as possible after getting work started, a progress schedule is made out. This schedule is a good thing even though contingencies may make necessary some revision of dates. In order to make out the schedule, the superintendent must necessarily plan the job thru and schedule a time table. This time table has several advantages. It carries the work along so it will be completed at the specified date the contract calls for. It tells the next move ahead so that sub-contractors are able to know weeks ahead when they must be on the job to complete their work. Furthermore, it is a pace maker for the men. The foremen know just what work must be completed at a certain time and they can hire men so it will be finished on schedule. Perhaps the greatest advantage of this time table is the harmony it creates in the working force. Each group of men know just when the work in a certain place must be complete for the next workman to do his work. If you have ever seen the confusion that sometimes results from two different tradesmen trying to work in the same place, it is easy to understand no harmony exists there. Tradesmen do not like each other in their way and usually will not tolerate it, so then one or the other must be idle till the

work is complete. Some organizations often try to pour concrete before carpenters have finished their form work. Immediately dissention springs up and like as not something will be overlooked from this undue and exasperating hurry.

Besides this, the time table is a guide at the main office. Office and field organization work along together. Receiving of payments, outlays, borrowing of money and many other details are ironed more easily.

Performance and cost records are equally serviceable tools. Cost keeping to the contractor is very essential. Of this the superintendent has a duty in addition -- he has to keep a personal cost check. Each superintendent will naturally have his own special plan of doing this, but in all cases it amounts to some field method of rapidly detailing cost so that every day's costs can be checked up on that day, with every previous day's cost, in all details. These cost records also are invaluable to the contractor. If the superintendent has each foreman give an account of how much work he did with so many men in such a length of time, then in the future estimates can be figured much more closely. Concrete form work, concreting, etc. are items which each organization has to work out costs for itself, under different conditions. There are no set rules as to estimating costs for form work and concrete work, and furthermore, there are no good books on the market today, that give this much desired information.

One thing that a young man who intends eventually to

become a contractor, should do when he enters the building game, no matter in what capacity -- he should make note of the amount of work various tradesmen can do in a day. For instance, under certain conditions, how much concrete can be poured by so many men, or how many square feet of formwork a carpenter can put up in retaining walls or floors, etc. In time, such knowledge along with experience, gives the new contractor and superintendent the jump over his fellow competitor.

Besides costs, a log of operations is required. This may well be a running history containing all orders or instructions exceeding the routine, which are received or given, statements of unusual occurrences affecting the work and accounts of disputes over any detail of the operation which later may play a part of the final estimate.

In many other ways records can be made to play an important part in superintendence, but without the big duty of the superintendent on the job is the exercise of that intangible influence which keeps the work going along with a swing and the client pleased with the results. Keeping the client's engineer ahead with his plans and instructions, seeing that estimates are put thru and payments kept regular, keeping materials shipments prompt and regular, keeping down waste in effort as well as in time, keeping harmony in the organization, keeping good relations with the client and the public, are a few of the duties which the good superintendent is required to perform.

LAYOUT OF PLANT EQUIPMENT, MATERIALS, etc.

Engineers and people closely observant with the erection part of the construction game estimate that the efficiency on the average large building is from 40% to 60% -- the lowest of all our modern industries, for we may call building an industry as its volume in the United States amounts to over six billion dollars annually. Take this six billion and see the amount that could be saved, would be but increase our efficiency 10% which is possible. A look at any large construction job and the inefficiency at times is appalling. Methods are improving but not as fast as they should. Perhaps it is because of the human element involved, but foreknowledge and forethought in planning the layout of plant equipment and materials will save thousands of dollars.

A very careful study must be made of plant layout and general organization in central districts of large cities, as is usually the case all materials, plants, etc., must be located within the building. This necessitates locating the concrete mixing plant and bins where unloading materials will not be a menace to traffic and at the same time will be as efficiently located as possible. Concrete plant arrangement is perhaps the hardest to organize efficiently. The elevators and bucket hoists must go where conditions allow them, for only in rare cases can openings be left for hoists and closed afterwards -- besides, such a procedure costs money. Usually then, the only alternative is to locate the hoist in the building in elevator shafts. In many

buildings there is a choice in this arrangement, as there may be several places left open for elevators, in different parts of the building. Sometimes two or more concrete plants are much more desirable than one. A superintendent must be able to analyze the situation and figure which is more economical. This can perhaps be easiest figured out by sketches of proposed elevators and the distance the concrete has to be wheeled in buggies, for this method is coming into use more than ever since the water ratio theory in concrete work is becoming recognized. A mixture of small slump does not work very well in cruting facilities unless the slopes are very steep.

Another question that confronts the superintendent is the amount of material to have on hand. In closely confined positions this is a very important question, especially when the building is just coming out of the ground. Too much material in this case is a detriment as every inch of space is usually occupied, leaving very little for working room. Then if a big order of lumber or aggregate and cement comes to the job, it means that it may be moved several times before it is used. On the W-M building, in the loop of Chicago, a large order of lumber arrived; very little of it was used for a week, yet it had to be moved twice by laborers, piece by piece. To do this it cost considerable besides valuable floor space.

In the large city, there is no excuse for such a condition. With the present facilities, most any building material will be brought to the job within three hours after ordering. Except of steel and material not carried in stock in a large

city there is not need to worry about not having enough material on the job. A few hours' notice is usually sufficient to take care of any emergency that is likely to arise.

There are three main methods of bringing material onto a job. First, by truck and second, by rail, and then a combination of the first two. Truck is used from the central warehouse to the place of construction at the present time -- they carry loads of very large capacity. Recently a fifty-one ton plate girder for the Midland Athletic Club in Chicago, was brought from the railroad to the job on a 4-wheel trailer. This shows that almost any seemingly extreme condition can be taken care of. The second method of rail is not so often used except in the industrial sections, as such facilities are not available in office building sections. Sometimes there are exceptions, as the Tribune Tower, one of the finest buildings in the country. A railroad runs by the building, underneath Michigan Boulevard. Advantage of this transportation was taken and practically every bit of the material came direct from the factory to building. In a case such as this, orders must be placed several days ahead so that the car will be spotted on time. If it is three or four days too early, provision must be made before hand to take care of the material.

Here are two different conditions and it is up to the superintende to see that he knows and understands the various steps that material goes through before he can use it. Under these conditions he must use his good judgment.

In handling steel there is a different problem to solve. Steel is made to order and each structural section fits

in a definite place. If the fabrication plant is several hundred miles distant, there is danger in delay on the railroad. The method that is being used to eliminate any trouble from that source is to rent some ground near the railroad and have all steel shipments made at least two weeks in advance. On the Monroe-Laosh building no arrangements to order ahead were made. Through some mistake a wrong shipment of steel was made and the cars that should have been sent out were not loaded. Probably an error that does not happen once in a thousand times, but it caused a complete lay-off on the work for three days, which meant over 100 men were either not working and a good share hunted new jobs with the result the men that did come back three days later were few; they had to break in new men and acquaint them with the work, a smooth running organization had been disrupted and it took nearly a week to get it back where it should be. It is hard to make even a rough estimate of the cash loss from this, but one thing is certain, it takes some time to get a mechanic acquainted with a new job, and a heavy labor turnover means loss of money.

The layout of the concreting plant is probably the most difficult problem in layout work. There are seven fundamental types of plant layouts:

1. Mixer in a pit. Sand and gravel is dumped on the ground on each side of the mixer pit. The mixer is charged by hand, using 6 cu.ft. carryalls.

2. Sand and gravel are unloaded from back dump motor trucks against a bulkhead at the charging hopper. Laborers are

required to trim material in the bulkhead but wheeling is not required.

3. Sand and gravel are delivered to a storage pile and re-handled from the storage pile to the mixer bulkhead by a stiff leg derrick with a clam shell bucket. The derrick may also be used for unloading cars or scows and handling to storage.

4. The mixer is above ground. Sand and gravel are delivered to the storage piles and re-handled to a 100 cu.ft. bin over the mixer by a stiff leg derrick. The derrick may also be used for unloading cars or scows and handling to storage.

5. The mixer is on the ground and material bin is above the mixer. Sand and gravel are delivered in back dump trucks and unloaded into a conveyor boat built into the ground. A chain-belt-bucket elevator conveys the sand and gravel from the nopper to the bin.

6. The mixer is in a 3' pit to avoid sheeting. There is a bulkhead against the charging hopper. Sand and gravel are piled against this bulkhead by a 24" belt conveyor from a conveyor boat in the street.

7. The mixer is above the ground. Sand and gravel are received by car or scow and unloaded into a 100 cu.yd. bin by a stiff leg derrick. The material is handled from the bin to the mixer in 1 yd. side tip cars drawn by an endless cable from a double drum hoist.

The comparative costs on these different layouts are as follows:

Jobs less than 3000 yards -- 3/4 yd. plant would be used, 50' wooden tower, 8 carryalls and 300 feet of run panels.

Jobs over 3000 yards -- 1 yard plant, tower 125 feet, 12 carryalls and 400 feet of run panels.

These are assumed as average equipment, depreciation counted. An estimate of the labor required for the operation of each plant, that is, mixing, hoisting and placing, has as a basis of \$6.50 for 8 hours. The unit cost per cu.yd. for mixing, hoisting and placing, was estimated for the 7 fundamental layouts as follows:

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| 1. \$2.30 cu.yd. | 2. \$2.10 cu.yd. | 3. \$2.00 cu.yd. |
| 4. \$3.00 cu.yd. | 5. \$2.05 cu.yd. | 6. \$2.05 cu.yd. |
| 7. \$2.00 cu.yd. | | |

In closely confined positions, as in the business districts of cities, the first and second methods are the ones generally used and the second one predominates. For not having a choice, the cost is but very little more than the most economical method. In observing several layout plans, all of them seemed to have been planned with a great deal of forethought to the layout of the plant. It is the minor things that are decidedly in need of a change. The placing of lumber materials, etc., is where there seems to be a chance for revision; if it were possible to give the minor things more thought, it would be much better.

Cement hoists and chutes are of several different types, from the high towers with automatic dump buckets to the wooden tower and small sectional chutes. There is no doubt but that sometimes they are great labor savers and do an efficient job if the concrete is wet enough. However, with the water ratio theory being accepted all over the country, chutes are not, and

cannot be used so effectively. Some companies even now claim buglies are much cheaper or as cheap as chutes, and much more dependable. Rather than use chutes (especially on buildings), contractors are recommending elevators as near as possible to the center of distribution and use the wheeling method of distribution.

A superintendent must look out for the passing of any bad material that arrives on the job; it is up to him to protect the contractor he is working for as well as his client. Poor material has more than one draw-back, it cheapens the work and may possibly cause rejection by the inspector. It lowers the reputation of the contractor and superintendent for good work, and at times costs much more to get it into use in the structure especially if it be lumber. Poor, knotty, crooked lumber takes twice as much labor to get it into position and then one is not sure of a neat, satisfactory workmanship. If any material is rejected, it should be marked so, put in a separate pile and taken off the job immediately, for if it isn't taken away, it is liable to be used unknowingly, and since the contractor pays for good material the superintendent should see he gets full value for his money.

On a piece of construction work where there is plenty of land to put all the materials on the job at the beginning, it is an entirely different condition, than where the location is confined. The amount of material to have on hand is unlimited except for financial reasons as well as the fact it may be several months before the material is used.

There is no limit as to the length of time to order ahead, except that the material be on the job in time. However, cement should not come much faster than it is used unless good dry storage facilities are at hand. If all the sand and gravel or crushed rock can be ordered at once, it means a much cheaper cost, uniform material and time can be saved in unloading if from cars or cartage costs will be cheaper if delivered by truck.

The type of concrete plant layout in places where there is much more space may be much different than where it is so confined. The main factor in this case is cost, rather than necessity.

Referring to the costs in the seven different layouts we see that types 3 and 4 are the cheapest, with types 5 and 6 optional. It is to be noted that derricks seem to be cheaper than a conveyor. Also a derrick may be very useful in unloading other material, thus saving in more ways than one.

One of the first things in the layout and starting of actual work is the sizes of equipment to use. Sometimes the question has been definitely settled beforehand when the bid was prepared. Other times it is not completely arranged till the work is ready to be started. There are different factors affecting the size of equipment and the amount.

(1) The size of job. (2) The desirability of completing the work quickly. (3) Amount of space for equipment. (4) Amount necessary to be invested in equipment.

Contractors who do a very large volume of business

do not advocate using concrete mixers of over 1 yard capacity. If work is such that one mixer will not handle it, they recommend using two mixers rather than a larger one. There are several reasons for this: A larger mixer costs more, is more cumbersome to handle; and is adapted to large work only. Furthermore, if two mixers are used and one should happen to break down, operations will not be completely stopped. However, it takes more to operate two mixers. Nevertheless, observers state that the advantages of the smaller plants of 1 yd. and under, outweigh any disadvantages.

As to the number of mixers it depends on the speed that is desired on the work. Many contractors use two machines where one might do; they have the second one for emergency and also use it when a large amount of concrete is poured in a short time. It is easy to calculate the number of mixers and size, by reading the specifications. If they limit the mixing to two minutes per batch then a 1 yd. mixer will be capable of handling from 200 to 240 yards of concrete in an 8 hour day.

Another factor affecting equipment is the speed that must be used to complete the building. If the owner is in a hurry to occupy the building and the contract calls for quick completion of the work, then the contractor may have to buy new equipment to finish the work. This requires additional investment in tools and machinery and should be taken into consideration when making the bid. If the job is in closely confined quarters then it may not be possible to use many or large tools and machinery.

On the new Stevens Hotel in Chicago, which cost \$30,000,000. to complete, it was necessary to carry the work along as rapidly as possible. The interest charges and other fixed charges amount to \$175,000. per month or \$6,000. per day. Here is a case where delay costs a great deal of money. In such a case it pays to install means by which work can be finished as rapidly as possible.

On foundation work, a different problem presents itself. It is slow, tedious work. To double the speed would probably treble the cost and the layout must be planned accordingly.

The amount of equipment and amount of money invested in equipment must be governed by the amount of work that can be depended on in the future. A large amount invested in equipment that is lying idle soon accumulates in overhead and fixed charges till the profit is reduced considerably. It may pay in many instances to rent equipment rather than stock up with new. There are many concerns at the present time that rent construction equipment at a moderate cost. One thing, be sure to have on work, and that is plenty of smaller tools, such as sledges, wrecking bars etc. and don't let them be taken out of the tool room without being checked out. Too many tools figuratively take legs and walk away, unless one keeps tab on them.

Besides having the proper equipment and enough of it on the ground, the superintendent must get material to work with, lumber, cement, nails, etc. He should let his foreman give him the orders and he check and O.K. them. He is too busy a man to do all this himself. If he has trustworthy

men working under him, there should be no trouble. Nevertheless, he should keep a check to see that there is not a shortage of material, especially that which has to be made up special or that which has to be shipped from a distant point. On the W-M building such a case happened and men had to be laid off and the whole work was disrupted. Such an affair costs big money, both to the men laid off and to the contractor. As all material ordered is already estimated by an estimator the superintendent does not need to bother about estimating on the job except in a minor way. He orders that which has already been estimated.

Before a superintendent starts work on a new building, he should be thoroughly familiar with the building code and regulations for the city and for that particular section of the city. In every city there are ordinances that require certain materials in a building. If the city inspector has passed the plans and specifications everything should be O.K. Nevertheless, it is up to the superintendent to know about these ordinances so if something has passed without being right he can quickly detect and remedy the trouble. The most important part of the Building Code the superintendent should know is the safety precautions that must be taken to protect the public as well as the mechanics working on the building. The requirements of most cities are that traffic must not be interrupted, canopies must be erected over sidewalks and proper precautions must be taken that human life will not be endangered.

When a canopy is built over the sidewalk it should be of heavy enough construction that it will stand a very severe shock without breaking.

On high structures joists should be 3" x 18" 12" on centers and of 10' to 12' span if made of wood, and if possible it is much better to use steel I beams. Decking should be of heavy plank and covered with roofing paper to keep off the rain.

When bringing steel to the building all traffic should be stopped as it is being hoisted into place. There is always one chance that a cable will break or a boom crumple and cause death and injury, to many. The superintendent should be careful about allowing men to "ride the steel" while it is being hoisted, especially when heavy loads are taken. Some companies forbid "riding" under all conditions as it is all at the man's own risk. When he does this he automatically cancels his insurance. The writer once saw a cable break when a load of steel was being hoisted. Fortunately, no one was on the load and the men below had time to reach safety before it hit the ground. The superintendent should watch to see that everything is strong enough to hold its load, and that hoists, derricks, elevators, etc., are not overloaded. On a large hotel in Chicago, the hopper that held the concrete after it was dumped from the automatic elevator, was situated on the fifteenth floor. The hopper was not supposed to be loaded over half full, or hold more than 1-1/2 yds. of concrete at any time. Thru some tie-up in the concreting operations the man at the hopper allowed it to fill to the top. As he was

a laborer he probably did not realize the consequences. The result was that the nopper tore loose and fell, killing three men and seriously injuring others. Though not directly responsible, yet the superintendent is held responsible by the contractor and the public for such a condition. In case a person is injured from falling material, the Company is liable to damages.

Recently in Chicago, during a heavy wind storm, large timbers used for scaffolding at the top of the 48-story Katter building were blown down onto Lacker Drive 470 feet below. Nobody was hurt but it was up to the superintendent to see that the scaffolding was guy-wired and braced enough to stand a heavy wind, as Chicago is subjected to heavy winds in the Spring of the year.

There are certain ordinances and general safety precautions that should be used on all buildings. One comparatively recent and far reaching law is the decking of every second floor as steel is erected, to protect the iron workers as well as tradesmen working below. Formerly, in some cities this did not have to be done but thru the efforts of organized labor it was accomplished. Then there are general safety steps such as water barrels at every floor to extinguish minor blazes. The recent fire in New York on the scaffolding several hundred feet above ground outside the reach of the fire apparatus shows the need for such protection as this.

Education of the men to use safety precautions is highly recommended. Following is a list recently compiled:

1. Personal education among employees in safety rules.
2. Periodical inspection of appliances used daily.
3. Insistence on part of contractor or superintendent that all jobs be kept free from debris.
4. Making compulsory the fencing of all floor openings and to boarding of scaffolding where bricklayers and masons are working.
5. Advertising by safety first signs and include propaganda in envelopes.

Even though the superintendent is hired by the contractors and is working for them he has certain duties and obligations toward the owner. He should try to do good work with the least amount of effort and should allow no faulty work to pass. If a mechanic does some work slovenly and of poor workmanship, make him remove it immediately. It may cost a little but you may rest assured that for a while he will do much better work. For a second or third offense it may be necessary to discharge a man. It costs no more to do good work and make a neat appearing job than it does to do poor workmanship. If a mechanic doesn't know his trade and does not at least try to learn it, it is much better to discharge him. Especially in riveting, although no one except the riveter and inspector knows whether a rivet is "sound" or not, yet it is highly essential that they are O.K. as every loose rivet weakens the building. In trim work floors and decorations, the work should be the best obtainable. The owner is usually impressed more by the appearance of the building than anything else. When he comes around to look at the work, show

him what has been accomplished -- explain the good points and good materials and workmanship.

The superintendent must also be on good terms with the engineer and inspector. If trouble is likely to develop about the work it will be with the engineer and inspector. They are paid by the owner or architect to see that the building is constructed as it should be and it is the duty of the superintendent to play square with them for if they once catch you trying to put something over they will be watching for you at every turn and a hostile superintendent and engineer do not increase the speed of a job by any means. The engineer, if on good terms with the superintendent, will give valuable suggestions that help make the work easier for the superintendent.

Lastly is the duty of the superintendent to the men that employ him, the contracting company. It is for them he is working and it is to them he should be loyal and do his best. The profit on a job depends on the superintendent -- how well he manages the work and how economically it is done. It is his duty to see a good standard of workmanship is insisted upon and efficiency should be a byword. Tell the foreman what your next step is, help them out in their planning. In lumber see that the most economical lengths are used, every little bit counts. In concreting build forms so they can be used over and over again without altering or wrecking. Many buildings are designed with that purpose in mind and the superintendent should take advantage of it. Encourage the use of labor saving devices such as power hand saws, which are coming into use very exten-

sively and many other easier methods which are cutting down construction costs annually. Many of these things a superintendent learns and becomes acquainted with only after years of experience and keen observation.

The modern large building is becoming more and more a case of specialized contracting. One firm takes the work as a whole unit and in turn re-lets the contract in sub-units. That is, the electrical work, steel work, etc., is handled by a sub-contractor. On such a construction job it is very important that these sub-contractors be on the job at the right time so the work will progress as a unit, as when it does not there is trouble and the work is held up. If the electrician does not lay his conduit lines before the reinforcing steel is in there is trouble between these two sub-contractors and they are disrupting the whole organization. It is up to the superintendent to have each sub-contractor have enough men there to do his work at the proper time.

The next problem of the superintendent is to see that each sub-contractor knows just what he has to do and that his limits are. There should be a definite understanding in the form of a written contract, telling exactly where each starts and stops. Many a time there is confusion and discord as to who is to set plates, bolts, etc., because there is not any exact wording in the contract. The cement man blames the carpenter and in turn the carpenter declares it is the iron man's job. Since neither is held down to it, the general contractor usually has to set them himself. Such a case happens

time and time again and one has to be sure it is covered in the plans and specifications given the sub-contractor.

If the superintendent can inform the sub-contractor a week ahead of time when he is needed on the work, it is to the advantage of both. Usually, however, on a big job, a representative is on hand and is in constant touch with the work so as to inform his organization as to when men are needed.

In most of the building centers at the present time, all of the building tradesmen are organized into labor unions. They do not present any special problem to the superintendent providing all men on the job are union and that union made material is used. Some unions have rules that they cannot work on a job where non-union men are employed. This is but an added safety code to the union men themselves, for union and non-union men come to differences very easily and it is a poor policy to employ union and non-union men at the same time.

There are certain working conditions most unions have and the superintendent should be familiar with them.

The unions were pioneers in making steel erectors use decking every second floor, before building codes included such an ordinance. They have conveniences such as tool and coat rooms where they may leave their tools and clothes without danger of theft, there are sanitary measures and drinking water facilities. Then each union has a representative who meets the foremen and adjust any grievance or difficulty. There are certain stipulations concerning working hours, overtime, etc. Most tradesmen work 8 hrs. a day and begin at 8 o'clock. For all overtime

they receive double time. Each union has a business agent who visits the work and sees that the men are union and are receiving a square deal. They have the power to "pull" a job if everything is not on the square. By "pull" is meant to call the men off the job and tie up the work until the job is satisfactory to the parties involved.

Drawing distinction between trades is not very hard as it has been definitely settled in the past. Each trade has its working rules and limits defined as well as the general ideas as to tools, etc. One tradesman may do a small job of another, providing there are not any of the other tradesmen on the job. These rules are more or less local in their nature and can be studied according to the locality.

There is still a big question in the minds of some people whether union men are alright and whether non-union men are not better.

In the past there has been much propaganda printed against the union; little faults were printed in glaring headlines and it seems that the word union has become a word to be detested by many. Perhaps if instead of unions they had been named associations or clubs or something of that nature it would have been better. The great economists of today base the high standard of living conditions on labor unions. The rise in conditions of prosperity of organized labor helps the non-organized man. Some of the very men who decry organized labor themselves belong to organized unions. The Chamber of Commerce, a nation-wide organization, is one of the largest unions in America. The various

trade associations all have union fundamentals in their by-laws, yet these same men cannot see themselves as others see them.

A union man is an equal of his fellow men, he gets a living wage. Some argue a union man does not get what he is worth sometimes. There is a fallacy, the union wages set are minimum wages and the employer can pay as much more as he wishes. Another thing union men know their trade, apprenticeship is required in most unions, in which the men get out and see and know what they are doing. Trade schools help, but before any man enters a union he must take an examination as to his ability in his trade. At present in Chicago there is a special board of examiners in the carpenters' union that are paid by the union to examine applicants to see whether they are capable of the work. Such examinations naturally raise the standard of workmanship. Usually union men are not "floaters" going from one place to another, like some men do. Taken altogether, the union man is better equipped to do a good piece of workmanship than the non-union man. He has more self-confidence, knows he is going to get a decent living wage and is an equal with his fellow workers. The state of the mind has a lot to do with the kind of workmanship a man does and a union man has a better chance to be free from fear than a non-union man. All in all the union man seems to produce better work than a non-union man who is fighting his way alone.

As all jobs are made with the meaning of the plans and specifications in mind, there should be no deviation from

then in any condition unless the owner or his representatives give their written consent. Some contractors attempt to get away with something but it is a very poor policy.

Some specifications are exceedingly strict while others are comparatively lenient. Floors, bolts, etc., for setting machinery and in power houses and waterworks must be very accurate. On one power house in Illinois, elevation of bed plates had to be within $1/32$ " and bolts within $1/16$ " of centers on a large plot. Such a contract is hard to fill and proper allowance must be made. Form work for concrete closer than $1/4$ " to $1/2$ " is much more expensive than one supposes. Lots of times it depends on the engineer how much and what is reasonably close. If he has a grade it is easy for him to find something to kick about if he wants to force one to live up to the specifications. However, the engineer has to be on the alert to see that nothing is put over and it certainly is easy to put it over on an inexperienced inspector. Even the men who are experienced, are sometimes duped.

On the 2nd story of a 22-story building in Chicago, there was to be poured an extra heavy slab of concrete on which a load of 45 tons was to be placed, which was a water tank. This was the last concreting on the building and the supply of cement has run short. The specifications called for a 4-bag mix but the superintendent figured a 3-bag mix would just do it. Everything went fine, when the first few batches were mixed the inspector was there and saw that put in 4 bags but he also noted that the supply was low. Being

experienced at the game he watched toward the last few batches from a place where no one saw him. Only two and three bags were going in at a mix. He immediately stopped the mixer, saw the superintendent and made him remove every bit of that concrete and pour it right. It was estimated the loss was at least a thousand dollars, just to try and save a few bags of cement. However, just to satisfy himself, the inspector drew on an optional clause in the contract and made the contractor load 45 tons of pig iron on the slab and test readings were taken for a period of two weeks to determine if there was any settlement. This optional clause would probably not have been enforced had not the superintendent been dishonest.

Many times the owner or architect orders changes in a building or has extra work. The superintendent should see that the Company has compensation for this work and there should be a definite understanding before this work is begun. Usually a clause in the contract covers such a situation.

Another condition that arises is when the contractor wishes to change some material. This should be done only when the owner gives his consent in writing. In a large apartment hotel cork flooring in the dining rooms was being laid in 6" patterns. Toward the finish the supply of 6" squares was used up but there were plenty of 12" squares that were being used for other rooms. The superintendent asked the owner if it was all right with him to use the 12". He gave his consent in writing. Later the architect inspected the work and was

indignant because the change had been made, as it was not in harmony with the rest of the work. The contractor had the owner's consent and nothing could be done about it.

The superintendent should be particular to see that the grade of material that is called for is used in all parts of the building, as it gives him a reputation for honesty and fair dealing.

Foundation work is the most uncertain of all structural work. The problems that are constantly arising, that were unlooked for are numerous and one should be constantly on the alert to cope with them. Test holes are usually made before actual work starts, to determine the character of the soil underneath the surface of the ground. On tall buildings these test holes extend to bed rock. If quick-sand is encountered then a big problem confronts the superintendent. If a small pocket, open caissons can still be used as they are in clay. But if a thick layer, then air pressure must be resorted to. In the Chicago district practically all the work is of the open caisson type. Although small pockets of quick-sand are sometimes encountered, by careful work they can be handled without using air pressure. The average depth in this district is from 100' to 120', clay being encountered most of the way. 15' to 25' is the depth that can be dug in a day according to the size of the caisson. The lagging is 2" to 3" thick, 6" wide and from 3' to 6' long. An electric hoist is used and heavy manila rope. The closed caisson is used in parts of New York and is a problem in itself to handle.

Removal of material from the job is accomplished by truck in most cases, although many times if a tunnel is close by this can be utilized to advantage. On a building on Monroe Street, in Chicago, many thousands of dollars were saved by taking this tunnel which is 60' underground and putting in a steel pipe so the dirt and material was dumped into cars which were run but a short distance to the lake front and emptied.

Many companies put in their retaining walls before they excavate to the full depth. An advantage in doing this is that it is not so difficult to brace the outer edges while the wall is being concreted, and the cost is but slightly more. A trench is dug where the wall is to be, heavy planks held by jacks are put in place as the trench is dug, the forms for concrete are then put in and the wall poured. Such walls are of reinforced design and are held in place by the columns of the building. In the modern building there are from 3 to 7 floors below street level and one must make a personal study of conditions before starting such work.

On the superstructure work in uncertain conditions that are encountered on foundation work, will not be encountered. One can generally be pretty sure just about what problems will arise and can cope with them in the proper way. The one main thing is to have a smooth running organization that gets the most work accomplished with the least amount of effort. If the superintendent can rely on his foremen, and see that they are working together, then he has a great deal of his hard work finished. He must make out cost and time records and should

see that each person in charge helps him do this in the proper way.

Some years ago very little building was done during the winter in the Northern climate; recently, however, this has changed some, the advantages of all season construction operations are rapidly being recognized and the cost is only slightly more in the larger buildings. Statistics recently compiled show the increased cost on large buildings is but 3% to 4% for winter construction and 5% to 6% for smaller buildings. However, the contractor will usually bid with less margin of profit for winter work, so his machinery will not be idle and also to keep his dependable men so the cost may actually be the same as summer cost. Winter work cuts down the overhead expense on summer work by keeping equipment busy the year round. It tends to stabilize the trade, keep thousands working the year round and it does not make a dull season in the winter and a rush season in the summer.

The problem of winter construction is not a difficult one, the main one being concreting. The superintendent should be thoroughly familiar with winter operations and protection for concreting. Following are some things that should be remembered in winter construction:

1. Always be prepared to enclose the work and supply heat whenever work that may run into cold weather is begun.
2. Aggregates are heated to best advantage by steam pipes (say 1-1/2" d) laid as a grill under the piles or by a 6' length of perforated steam pipe inserted into the pile of

aggregate.

3. Water is heated by running a steam pipe into a water barrel.

4. A 50 H.P. boiler carrying 50# to 60# of steam is required for a large job but an 18 to 25 H.P. boiler is sufficient for jobs not more than 5000 sq. ft. of floor area.

5. One salamander is usually sufficient for 300 sq.ft. of floor area.

6. Columns should be concreted at the same time as the floor and column tamping continued an hour or more after the floor is concreted.

7. Bases of exterior columns are most difficult to protect and in extremely cold weather a salamander should be placed on each side of the exterior columns.

8. For unusual speed or exceptionally cold weather or when monolithic walls are carried up the lower floors should be curtained and salamanders placed at exterior columns.

9. Apply fuel frequently and in small quantities, to minimize smoke and provide uniform temperature.

10. Water barrels should be provided to extinguish fires and care taken to keep canvas from blowing against salamanders.

11. A detailed and accurate temperature record should be kept showing date, hour, outside temperature, temperature at bottom of columns, underside of slab, under canvas over slab, temperature of concrete as deposited and especially temperature at bases of exterior columns on windward side of building.

12. Air at a minimum temperature of 60° F. within the

enclosure for five days. During protracted cold weather keep the tarpaulins up and maintain a temperature of not less than 40° F. for ten days additional.

13. Do not remove permanent shores until the strength is shown to be 3/4 the design strength of the concrete.

14. Do not depend on anti-freezing compounds instead of protection and heat. Accelerators do not furnish heat to start the hardening process but once started accelerators will cause the concrete to gain strength faster if it is kept warm.

No accelerators or anti-freezing compounds should be used that will decrease the final strength of the concrete, causing rusting of steel or producing efflorescence. Temperature above 50° will be O.K. for concrete but 70° is better.

Care must be taken in using salamanders after fine finished floor is on or the fumes, etc., may injure the floor. Some contractors put in the heating system as fast as the building is put up, installing temporary radiators at each floor so as to keep a fairly even temperature.

On many construction jobs, the superintendent must be both superintendent and engineer, as the work is not enough to keep an engineer busy, so if a man is capable, as he should be, of engineering, in a general sense, using the level and transit it will give him a big boost upward. On buildings up to \$100,000. in cost, one man can usually handle both superintendence and engineering to good advantage, especially where the work is slow.

The superintendent should be in close touch with the laws of the State regarding workmen's compensation and he should

live up to them. He should also have a place to which he can send men that are injured and have medical treatment given them. Always keep a first aid kit on the job and educate the men to take care of the slightest wound. On construction work it is easy for even a skin abrasion to become infected. Do not leave boards with nails in them lying around; pull them out or bend over the nails.

Another thing to look out for is adjacent property; if too much excavating is done under another building, it is likely to cause trouble. On Chicago Ave., excavating was carried on next a 4-story building, the building collapsed, probably due to settling. This will cost the excavating company a great deal to cover the cost of damages.

Efficiency on the job is very much needed at the present time; with the cost of labor rising faster than building material, the superintendent must take care to see that every one is doing his best. Not necessarily a rasher, but do and make every step count. Put material where it requires least handling and carrying, plan your work so it goes along smoothly.

There is a large field in building superintendence for men who can do the work and the remuneration is ample for a good living. A good superintendent can earn from \$5,000. to \$10,000. yearly. However, it is not the money that should count but the spirit of achievement; to see a building grow up and up is fascinating, but to direct the operations that make that building grow is accomplishment and success.

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