PAGES

MISSING

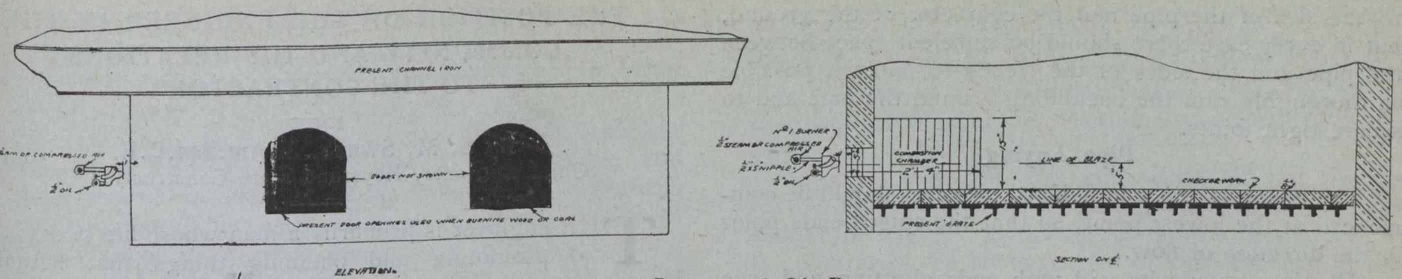


Fig. 7.—General Layout of Oil Burners

cap of the rear bearing is water-cooled. The front bearing is smooth, which permits sufficient lateral movement to take care of the expansion and contraction of the drum when it is alternately heated and permitted to cool off. The drum is driven by a manganese steel beveled pinion and heavy beveled driving gear with a 5-in. face. The cold stone elevator is driven by a heavy chain and sprocket as shown in the illustration. When firing this drier with oil the grate surfaces are covered over with a loose layer of brick. In the event that oil should temporarily be unavailable, it is a simple matter to remove these brick and use coal.

Fig. 6 shows standard weigh boxes, which are equipped with a flanged shutter gate, the bottom of the discharge chute being composed of a flipper gate, which, when reversed, permits of by-passing of a rejected batch directly downward through the mixer platform into a wagon if desired.

Fig. 8 illustrates the method of suspending the asphalt weighing bucket, using a two-beam scale, which

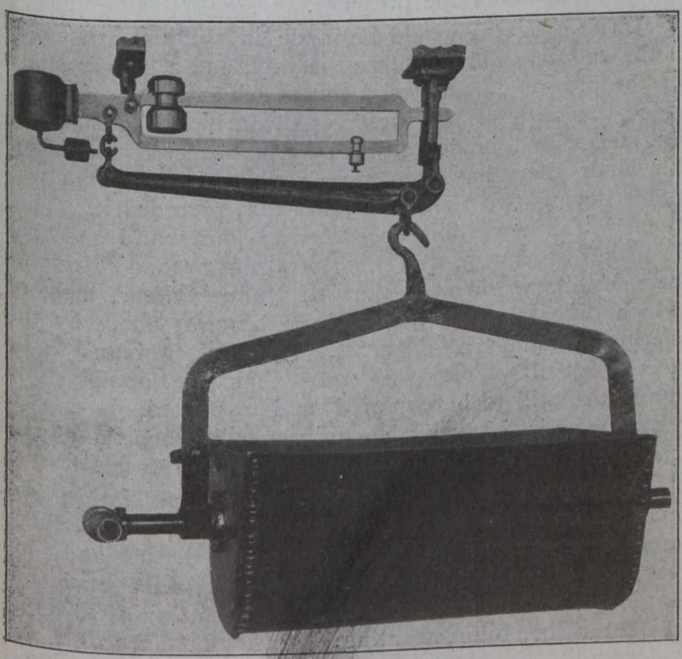


Fig. 8.—Asphalt Weighing Bucket

greatly facilitates the weighing of the asphalt, as it permits balancing the bucket and obtaining the correct weight without figuring the tear.

Fig. 7 shows the general layout of the oil burners, which heat the bitumen and sand, and were supplied by W. N. Best, Inc., New York City. It will be noticed that a combustion chamber is used at the burner end, the present grates being covered with firebrick to protect them from excessive heat. Oil is an excellent fuel for asphalt work, owing to the fact that the temperature can be controlled perfectly and the maximum output can be got from the plant. It is also economical, as when the dryer becomes too hot the flume from the burner can be turned off completely or reduced at will.

With oil burners the sand dryer can be heated sufficiently to pass sand through in about fifteen minutes. whereas with coal two or three hours were taken up in heating.

About 300 gallons of oil are consumed daily at the city plant with five burners, ordinary fuel oil being used.

The superintendent of erection was Mr. MacDonel, of the Warren Bros. Co.

TENTATIVE RECOMMENDED PRACTICE FOR LAYING SEWER PIPE

At the recent annual convention of the American Society for Testing Materials the following recommendations of Committee C-4, of which Mr. Rudolph Hering is chairman, regarding practice in laying sewer pipe were accepted for publication as tentative standards. of the society.

Preparing Trenches and Foundations for Pipe Laying

The foundations in the trench should be formed to prevent any subsequent settlement and thereby possibly an excessive pressure and consequent rupture of the pipes.

If the foundation is rock an equalizing bed of concrete or sand well compacted should be placed upon the rock. The thickness of these beds should be not less than 4 ins. Pipes should be laid in these beds so that at least the lower third of each pipe is supported its entire length.

If the foundation is good firm earth, the earth should be pared or molded to give a full support to the lower third of each pipe and, if necessary to secure a proper bearing for the pipe, a layer of concrete, fine gravel or other suitable material should be placed. The same means of securing a firm foundation should be adopted in case the excavation has been made deeper than necessary.

If there is no good natural foundation, the pipes should be laid in a concrete cradle supported on a masonry foundation carried to a soil of satisfactory bearing power or supported on a structure designed to carry the weight of pipe and its load to a firm bearing.

Trenches should be kept free from water until the material in the joints and masonry has sufficiently hardened.

To protect pipe lines from unusual stresses all work should preferably be done in open trenches.

Pipe lines should be placed at a sufficient depth below the surface of the street to avoid dangerous pressure or impact. When this is not possible special reinforcement should be provided.

Trenches should be only of sufficient width to provide a free working space on each side of the pipe, according to the size of the pipe and the character of the ground, but in every case there should be sufficient space between the pipe and the sides of the trench to make it possible to thoroughly ram the backfilling around the pipe and to secure tight joints.

Pipe Laying

The laying of pipes in finished trenches should be commenced at the lowest point, so that the spigot ends point in the direction of flow.

All pipes should be laid with ends abutting and true to line and grade. They should be fitted and matched so that when laid in the work they will form a sewer with a smooth and uniform invert.

It is necessary to use all possible care when shoving the pipes together, so that the joints will not be unnecessarily large.

Bells should be carefully cleaned before pipes are lowered into trenches. The pipes should be so lowered as to avoid unnecessary handling in the trench.

The pipes should be set firmly according to line and grade, and the joints carefully adjusted and filled with the jointing material.

Joints should be made in the following manner: A closely twisted hemp or oakum gasket of suitable diameter, in no case less than ¾ in., and in one piece of sufficient length to pass around the pipe and lap at the top, should be solidly rammed into the annular spaces between the pipes with a suitable caulking tool. When cement joints are used, the gasket should first be saturated with neat cement grout. The remainder of the space should then be completely filled with the jointing materials.

Backfilling Trenches

All trenches and excavations should be backfilled immediately after the pipes are laid therein, unless other protection of the pipe line is directed. The backfilling material should be selected and deposited with special reference to the future safety of the pipes. Clean earth, sand or rock dust should be solidly tamped about the pipes up to a level at least 2 ft. above the top of the pipes. This material should be carefully deposited in uniform layers. Unless otherwise permitted, each layer should be carefully and solidly tamped or rammed with proper tools so as not to injure or disturb the pipe line.

Puddling or water flooding for consolidating the backfilling is recommended only for sandy and gravelly materials. If this method is used, the first flooding should be applied after the backfilling has been compacted by tamping up to 2 ft. above the top of the pipes, and the second flooding during or after the subsequent filling of the trench. An excess of water should be avoided, in order to prevent disturbance of the earth under and around the pipes and also to prevent an undue excess of pressure upon them.

Walking or working on the completed sewer, except as may be necessary in tamping or backfilling, should not be permitted until the trench has been backfilled to a height of at least 2 ft. over the top of the pipes.

The filling of the trench should be carried on simultaneously on both sides of the pipes in such a manner that injurious side pressures do not occur.

An important programme of mining development is being undertaken by the Duchy of Cornwall, England, the principal object being the recovery of wolfram. This mineral is at present in great demand for the production of tungsten, a metal which is necessary for the manufacture of high-speed steel.

THE POSITION OF THE ENGINEER IN THE COMMUNITY AND HIS RELATIONS TO THE CONTRACTOR*

By S. M. Swaab, M.Am.Soc.C.E.
Chief Engineer, Keystone State Construction Co.

THE engineer is primarily a man whose life is devoted to promoting and planning things that actually happen, and without doubt he is slowly but surely assuming his rightful position in the world, because it is becoming universally recognized that he, above all of his fellows, is better fitted by his education, experience, and, generally, his temperament to fill those positions in the direction of the world's material progress which require, among other things, sound, sane and intelligent judgment and at the same time administrative ability, energy, technical and scientific knowledge of a high and varied order.

Of course, initiative, candor, truthfulness and efficiency, and, above all, integrity, are presupposed and, let us hope, can usually be taken for granted.

Engineering is an art and a science. It is a science in so far as certain physical laws are its basis. It is an art in so far as in the application of these laws the best judgment inherent in or acquired by man must be exercised. It is the engineer who is the pathfinder and pacemaker in modern civilization, and it is he who more nearly than any other individual can be likened unto Jove of old, whose command of the elements used to be universally acknowledged and is proverbial, and it is the engineer who, to-day, is largely charged with encroaching on his ancient and honorable preserve.

Little progress would be made in the modern world if the engineer did not blaze the way, and a giant's share of the progress in material things which has been made since the birth of the First Napoleon has been made by engineers, and incidentally it may be observed that, since his birth, there has been more actual progress than was made during two thousand years that preceded it. That there is far more difference between our world and that in which Bonaparte was the central figure than there was between his world and that of Julius Caesar, most of which difference has mainly been brought about by the engineer, cannot be disputed. Much yet remains to be accomplished. Unknown and exhaustive domains no doubt are still to be explored and exploited, but, stupendous as is the task, the engineer will, when the day of reckoning arrives, be found to be in the forefront.

To cope with those impediments which Nature and man set up in the way of material progress, and to transmute or convert these into processes for the use and convenience of mankind, is the acknowledged function of the engineer, and he has not heretofore been, nor shall he in the future be, found wanting.

To be more specific, in the ultimate analysis the elemental components, physical, mental and moral, which in the ensemble constitute the engineer, as herein stated, may be said to be character and experience, imagination, efficiency, executive and technical ability and scientific knowledge. While no one of these principles can be said to dominate the rest, still in a general sense there is no disputing the fact that character stands first. It is the framework or foundation on which the other characteristics are built.

---

*From the September Proceedings of the Engineers' Club of Philadelphia, Pa.

Technical ability and scientific knowledge are not written first because it is thought to be of little importance, but because ultimately the other principles being broader have a bigger bearing on the resultant man.

A man may be a great engineer with only sufficient scientific knowledge to eliminate the impossible and whose sole characteristics are his imagination, ingenuity, and experience, but who possesses a mind capable of conceiving or forecasting and in rare instances defining the desirable and necessary (as the case may be) in the human economy. Such was the elder De Lesseps, James J. Hill, Harriman, Carnegie and a host of others among the pioneers in industry on this continent.

Imagination is to be interpreted as broad vision, creative ability. Technical ability considers scientific knowledge applied in the light of experience, reason and common sense. Efficiency is generally defined as the ratio of the work expanded to that produced and in a larger sense is the process of effectively correlating all of the operating forces and energies in one unit for economical production. Executive ability is the process of successfully commandeering and utilizing the services of others.

The provinces of engineering and economy are often intertwined to such an extent that it cannot be said distinctly just where one ends or the other begins. Engineering which is not economical is not good engineering, and economy which will not bear rigid scientific investigation or treatment, such as an engineer would subject it to, is not economy.

Where we attempt a rigid mathematical analysis in any instance, we must be sure of the premises, and it should be remembered that scientific analysis does not necessarily mean mathematical precision to the exclusion of the broader judgment based on experience and common sense.

An engineer's enducation after it reaches a certain stage should be along broad lines, to include the humanities, so as to fit him for leadership.

A knowledge of men which the old school believes can only be had by contact, but which some now seem to think can be obtained through the mastery of what has been called the Science of Character Analysis of Dr. Blackford, is more to be desired than a knowledge of integral calculus and by all odds gives one a better chance in life.

Many engineers are of necessity employed by industrial and commercial organizations. Some are born to lead and others to serve—in whatever class we find ourselves it is up to us to do our utmost. To be able to intelligently and successfully carry out orders is a faculty not to be dispised and, by the way, it is not the easiest task imaginable.

An engineer's actions should be guided solely by the Golden Rule, and equity, not policy; that is, strict justice, rather than law, should govern. In his relations with the contractor he occupies a sort of judicial position, and must possess great discriminating powers and must appreciate point of view.

It is better to be right and to act justly, even if appearances are against you, than to be guilty of a wrong, even with appearances in your favor.

In his relation to his employers it goes without saying that they are the sole judges as to his ability and fitness. In his dealings with them he must possess candor and ability to look out for their interests without sacrificing his own. It is a fact that is not to be disputed that he must be true to himself, first, and that he must not forget or overlook his own interests.

To become so absorbed in your work as to be oblivious to one's own interests is not demanded by any of the precepts or the examples that we have of the greatest of our professional brethren, and it can rightfully be said that disloyalty is a crime, whether to one's self or to one's employers or clients.

In every instance the contractor should receive a square deal at the hands of the engineer and in no instance should the engineer have it in his mind to get square with the contractor for some fancied or even real act of omission or commission. Those who have had sufficiently broad experience recognize that specifications are intended to be interpreted in the spirit, rather than in the letter. As Theodore Cooper, in his day recognized as the foremost bridge engineer in this country, put it, "The best system of rules to insure success must be interpreted on the broad grounds of professional intelligence and common sense."

Constant bickering, indicating lack of poise and persistent petty fault-finding without being able to offer suggestions for the betterments of conditions, is the method pursued by many young engineers to the detriment of the work on which they are engaged.

There is absolutely no reason why the most cordial relations should not exist between the contractors and engineers engaged on the same work and there are probably the very best of reasons why they should, as their interests are alike.

The specifications are often the rock on which the cordial relations of the engineer and the contractor are rent asunder.

Contractors, like engineers, are actuated by the same motives as other men. The engineer may or may not be superior to the contractor, but he cannot show his superiority by taking undue advantage of him.

Contracting, according to the usual methods in vogue, of which some one has aptly said, "The profits are limited by competition, but the losses may be unlimited," should no longer prevail, but as it is or should be a legitimate business, the gambling element should be removed therefrom, and should certainly not exist to a greater extent than it exists in any other ordinary business.

Contractors would be better men as well as better contractors if their remunerations were fixed, rather than problematical, as is usual.

The party for whom the work is being done should take all of the incumbent risks, and then any incentive of the contractor to take advantage is removed.

Some specifications deliberately give the engineer the whiphand, but it has been determined in the courts of this country that it cannot be employed without considerable danger. As engineers, we know that the action and reaction are equal.

Clauses which have a double meaning or which can be interpreted in two ways should not be written in specifications. A contract represents a meeting of the minds of the contracting parties. The engineer should not attempt to protect himself by inserting obscure clauses in specifications whereby he may cover up his own ignorance or shortcomings at the expense of the contractor.

Copying clauses from one specification into another without fully understanding their meaning, simply because they are time-honored, *i.e.*, because custom has sanctioned them, which is not unusual, is a very silly and at the same time dangerous practice.

Few men have ever been vested with considerable power who haven't at times abused it, and the engineer who prepares the specifications and who interprets them and who in the case of dispute has the last say, in fact is the "sole arbiter," has to be a bigger man than the ordinary to be absolutely unbiased. In the case in question the engineer is judge, jury and prosecuting attorney, all welded into one, and the one who usually suffers, and to whom is meter out the punishment, unless the engineer happens to be a very big man, is the contractor.

EFFECT OF MOUTHPIECES ON FLOW OF WATER THROUGH SUBMERGED SHORT PIPE

An investigation has been completed by the Engineering Experiment Station, University of Illinois, Urbana, Ill., under the direction of Fred B. Seely, Associate in Theoretical and Applied Mechanics, to determine the effects of mouthpieces upon the flow of water through a submerged short pipe. The experiments involved the use of a cast-iron pipe 22½ ins. long and 6 ins. in diameter, bored to a smooth surface. Cast-iron conical mouthpieces of different lengths and angles were used. The results of the investigation are set forth in detail in a bulletin issued last month by the Engineering Experiment Station. The conclusions drawn from the experiments follow:—

As applying to conditions likely to be met in engineering practice, the value for the head lost at the entrance to an inward-projecting pipe (*i.e.* without entrance mouthpiece and not flush with wall of the reservoir) is 0.62 of the velocity head in the pipe ($0.62\frac{v^2}{2g}$) instead of $0.93\frac{v^2}{2g}$, as usually assumed. To put it in another form, the coefficient of discharge for a submerged short pipe with an inward-projecting entrance is 0.785 instead of 0.72, as given in nearly all books on hydraulics. Further, the lost head at the entrance to a pipe having a flush or square entrance is 0.56 of the velocity head in the pipe ($0.56\frac{v^2}{2g}$) instead of $0.49\frac{v^2}{2g}$, as usually assumed. In other words, the coefficient of discharge for a submerged short pipe with a flush entrance is 0.80 instead of 0.82, as given by nearly all authorities.

The loss of head resulting from the flow of water through a submerged short pipe when a conical mouthpiece is attached to the entrance end, may be as low as 0.165 of the velocity head in the pipe ($0.165\frac{v^2}{2g}$) if the mouthpiece has a total angle of convergence between 30 and 60° and an area of ratio of end sections between 1 to 2 and 1 to 4 or somewhat greater. In other words, the coefficient of discharge for a submerged short pipe with an entrance mouthpiece as specified above is 0.915.

The loss of head which occurs when water flows through a submerged short pipe having an entrance mouthpiece varies but little with the angle of the mouthpiece if the total angle of convergence is between 20 and 90° and if the area ratio is between 1 to 2 and 1 to 4 or somewhat more. The loss of head for any mouthpiece within this range would be approximately 0.20 of the velocity head in the pipe ($0.20\frac{v^2}{2g}$). There is, therefore, little advantage to be gained by making an entrance mouthpiece longer than corresponding to an area ratio of 1 to 2. Thus, an entrance mouthpiece with a total angle of convergence of 90° and the length of which is only 0.2 of the diameter of the pipe gives approximately $0.20\frac{v^2}{2g}$ for the loss of head.

The amount of velocity head recovered by a conical mouthpiece when attached to the discharge end of a submerged short pipe depends largely upon the angle of divergence of the mouthpiece, but comparatively little upon the length of the mouthpiece. This is true for lengths greater than that corresponding to an area ratio of 1 to 2 and for total angles of divergence of 10° or more. The amount of velocity head recovered decreases rather rapidly as the angle of divergence increases from a total angle of 10 to 40°. At or near 40° the amount of velocity head recovered rather abruptly falls to approximately zero.

A conical discharge mouthpiece having a total angle of divergence of 10° and an area ratio of 1 to 2, when attached to a submerged short pipe, will recover 0.435 of the velocity head in the pipe, which is 58 per cent. of the theoretical amount possible of recovery.

The amount of velocity head recovered by a diverging or discharge mouthpiece when attached to a submerged short pipe is considerably more when a converging or entrance mouthpiece is also attached than it is when the entrance end of the short pipe is simply inward-projecting (no mouthpiece attached). This excess in the velocity head recovered diminishes rather rapidly as the angle of the discharge mouthpiece increases, and it becomes zero for a discharge mouthpiece having a total angle of divergence of approximately 40°. This increase in the velocity head recovered is probably due to the effect of smooth flow in the pipe as the water approaches the discharge mouthpiece. The smooth flow allows the mouthpiece to recover more of the velocity head in the pipe than when a more turbulent flow exists; this increase amounts to as much as 33 per cent. in the case of the discharge mouthpiece having a total angle of divergence of 10° and an area ratio of 1 to 2.

QUEBEC BRIDGE EQUIPMENT

Through the courtesy of E. C. Kerrigan, chief draughtsman and purchasing agent of the St. Lawrence Bridge Co., of Montreal, *The Canadian Engineer* has been supplied with the following list of firms who made the equipment and materials with which the great Quebec Bridge was constructed. While this list may not be absolutely complete, it is thought that it represents the main purchases. *The Canadian Engineer* will be pleased to hear from any manufacturer who supplied any materials or machinery for the Quebec Bridge and whose name is not included in the following list, as a supplementary list will probably be published at a later date.

Air compressors, Canadian Ingersoll-Rand Co., Montreal.

Air drills, Canadian Pneumatic Tool Co., Montreal; Independent Pneumatic Tool Co., Montreal.

Air hammers, Canadian Pneumatic Tool Co., Montreal; Cleveland Pneumatic Tool Co., Toronto.

Air holders-on, American Bridge Company, Pittsburgh; Canadian Pneumatic Tool Co., Montreal.

Air hose, Gutta Percha & Rubber Co., Montreal; Canadian Consolidated Rubber Co., Montreal.

Air receivers, Canadian Ingersoll-Rand Co., Montreal.

Air rock drills, Canadian Pneumatic Tool Co., Montreal.

Asbestos sheeting, Canadian H. W. Johns-Manville Co., Montreal.

Ball bearings, Hess Bright Mfg. Co., Philadelphia.

Cable, Northern Electric Co., Montreal.

Car replacers, F. H. Hopkins & Company, Montreal.

Cast steel shoes, Canadian Steel Foundries, Montreal.
Chain blocks, Herbert Morris Crane & Hoist Co., Toronto.
Chains, Frothingham & Workman, Montreal; B. J. Coghlin & Company, Montreal; Bradlee & Company, Philadelphia.
Concrete mixer, Foss & Hill Machinery Co., Montreal.
Core shot drills, Canadian Ingersoll-Rand Co., Montreal.
Electric brakes, Electric Controller & Mfg. Co., Cleveland; Jenckes Machine Co., Sherbrooke; Mead, Morrison Mfg. Co., East Boston.
Electric controllers, Electric Controller & Mfg. Co., Cleveland.
Electric elevators, Darling Bros., Montreal.
Electric hoists, Mead, Morrison Mfg. Co., East Boston; Jenckes Machine Co., Sherbrooke.
Electric motors, Canadian General Electric Company, Montreal.
Electric overhead traveling cranes, Northern Crane Works, Walkerville.
Electric portable drills, Canadian Pneumatic Tool Co., Montreal; Independent Pneumatic Tool Co., Montreal.
Electric switchboards, Canadian General Electric Company, Montreal.
Electric transformers, Canadian General Electric Co., Montreal; Moloney Electric Company, Montreal.
Electric wiring, Canadian General Electric Co., Montreal; Northern Electric Company, Montreal.
Eyebars, American Bridge Company, Pittsburgh.
Flat cars, Canadian Car & Foundry Co., Montreal.
Forged pins and sleeves, Bethlehem Steel Company, Bethlehem; Midvale Steel Company, Philadelphia.
Fork wrenches, Canadian Billings & Spencer Co., Welland; F. H. Hopkins & Company, Montreal.
Hand rivet forges, Canadian Blower & Forge Co., Kitchener, Ont.
Hose fittings, Canadian Pneumatic Tool Co., Montreal.
Hydraulic jacks, R. Dudgeon, New York City; Watson-Stillman Company, New York City.
Iron tank cars, Universal Iron & Supply Co., St. Louis.
Lightning arrester, Canadian General Electric Co., Montreal.
Locomotive cranes, Industrial Works, Bay City, (purchased through F. H. Hopkins & Co., Montreal).
Locomotives, Montreal Locomotive Works, Montreal.
Machine shop equipment, J. Bertram & Sons, Dundas; Williams & Wilson, Montreal; Foss & Hill Machinery Co., Montreal; H. W. Petrie & Company, Montreal.
Manganese bronze bushings, Paul S. Reeves & Co., Philadelphia.
Manila rope blocks, Boston & Lockport Block Co., East Boston; Canadian Fairbanks-Morse Co., Montreal.
Manila rope, Consumers Cordage Co., Montreal; Independent Cordage Co., Montreal.
Mayari steel bolts, Pennsylvania Steel Company, Philadelphia.
Metaline bushings, Metaline Co., Long Island City.
Motor-driven track cars, Canadian Fairbanks-Morse Co., Montreal; Holden Company, Limited, Montreal.
Motor generator sets, Canadian General Electric Company, Montreal.
Oil Rivet Furnaces, American Equipment Co., Norristown.
Paint spraying machine, Dominion Electric & Brass Goods Co., Toronto.
Pumps, F. H. Hopkins & Co., Montreal; Canadian Fairbanks-Morse Co., Montreal; Williams & Wilson, Montreal.
Push cars, Canadian Fairbanks-Morse Co., Montreal.
Rivet and Bolt Steel, United States Steel Products Co., New York.
Screw jacks, Mussens, Limited, Montreal.
Springs, Canadian Steel Foundries, Montreal; B. J. Coghlin & Company, Montreal.
Steamboat ratchets, McClintic, Marshall & Company, Pittsburgh.
Steam hoisting engines, M. Beatty & Sons, Welland.
Steel rails and fittings, Algoma Steel Corporation, Sault Ste. Marie; United States Steel Products Co., New York; Steel Company of Canada, Limited, Montreal.
Storm detector, Northern Electric Company, Montreal.
Structural shapes and plates, United States Steel Products Co., New York.
Surveying instruments, Hughes-Owens Company, Limited, Montreal.
Telephones, Northern Electric Company, Montreal.
Trolley wire, Northern Electric Co., Montreal.
Trucks, Canadian Car & Foundry Co., Montreal.
Turnbuckles, Cleveland City Forge & Iron Co., Cleveland.
Twist drills and reamers, Eagle & Globe Steel Co., Montreal.
Wire rope, Dominion Wire Rope Company, Montreal; John Roebling & Sons, New York.
Wire rope blocks, W. W. Patterson Co., Pittsburgh; Boston & Lockport Block Co., East Boston.
Wire rope slings, Dominion Wire Rope Company, Montreal; John Roebling & Sons, New York.

OTTAWA SCAVENGING WAGONS

Andrew F. Macallum, C.E., commissioner of works, Ottawa, Ont., has designed a special wagon for use by the city's scavenging department. On account of the nature of the material handled and of the dumping arrangements necessary at the incinerator, it was deemed advisable that rear-dump wagons be used and not the usual type of bottom-dump. By an ingenious arrangement of a loose canvas strip laid in the bottom of an ordinary box wagon, Mr. Macallum has devised a means

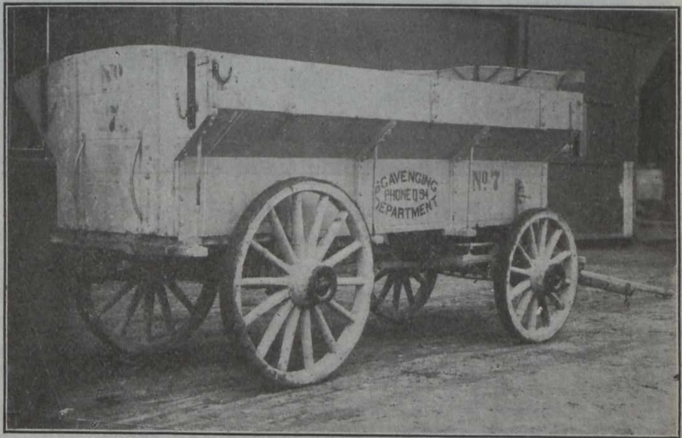


Fig. No. 1.—Ottawa Scavenging Wagon

whereby the load can be removed in one minute's time under favorable circumstances, although the time of unloading varies somewhat according to the composition and weight of the load to be rolled out.

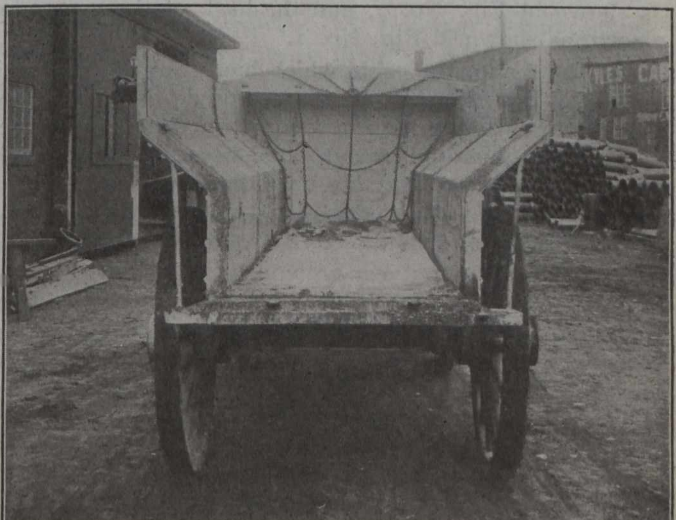


Fig. No. 2.—Tail-board Down; Unloading Device in Place Ready for Another Load

Fig. No. 1 is a general view of the type of wagon being used at Ottawa. It has a water level capacity of six cubic yards. There is a removable tail board, and on one side of the wagon the upper board is on hinges, so that it may be swung outwards and downwards to facilitate loading up to the level of the hinges, the board then being swung up and fastened before loading the final portion of the material.

Fig. No. 2 is a rear view of the wagon, showing the unloading device. This device consists of five chains fastened only to the rear end of the floor of the wagon. There are cross-chains placed every eighteen inches, and

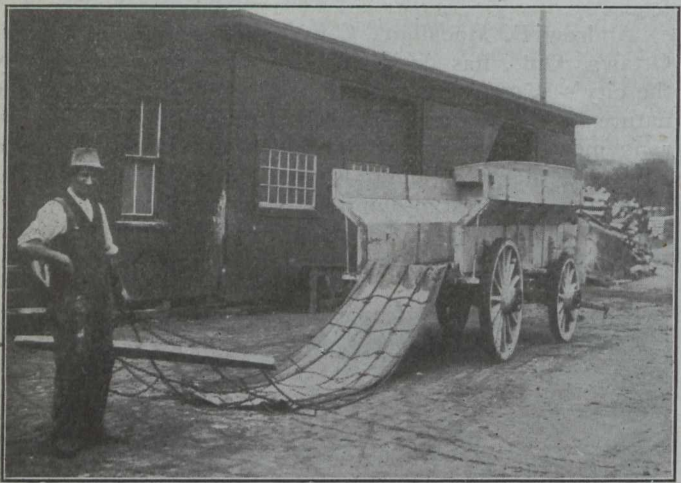


Fig. No. 3.—Position of Unloading Device Just After Load Has Been Dumped

the whole network of chain is covered with canvas, fastened with clips, so as to lay flat along the bottom of the wagon on top of the chains. The longitudinal chains are fastened at the front to a hardwood cross-piece, and are then joined in one ring.

When the wagon has been loaded and reaches the incinerator, the ring on the cross-bar is attached to a cable, and a motor at the incinerator rolls the load out over the back of the wagon, the unloading device ending in the position shown in Fig. No. 3. From this figure it will be seen that the load is all dumped behind the rear wheels, and that the unloading device is on top of the load just dumped, so that it can be quickly placed back in position, as shown in Fig. No. 2, and the back of the wagon replaced, as shown in Fig. No. 1.

At the dump, the cable which hauls out the canvas is pulled by horses. The horses required to haul these scavenging wagons have a weight varying from fifteen to seventeen hundred pounds, and horses of this weight are capable of handling this unloading device.

A patent for this device was applied for recently, but was not granted, as it was shown that it had been in use in Ottawa for about a year previously. The device makes it possible to use any ordinary box wagon as a dump wagon. This type of wagon was adopted by Mr. Macallum after investigating all the different types of back-dump and under-dump wagons, and he has found it to work in a very satisfactory manner.

Operations are now actively under way by the Chicago, Milwaukee and St. Paul Railroad Company for the electrification of the line over the Cascade Mountains, and rapid progress is being made. The area to be converted is from Othello to Seattle and Tacoma, a distance of 211 miles.

NOTES ON ACTIVATED SLUDGE WITH PARTICULAR REFERENCE TO THE TREATMENT OF PACKINGHOUSE WASTES*

By Langdon Pearse
Division Engineer in Charge Sewage Disposal Investigations, Sanitary District of Chicago.

WITH the concentration of packinghouses near or in large cities, the problem began of treatment to avoid nuisance. In Chicago this condition arose in the early sixties. In other localities the difficulties appear of more recent origin. Economies enforced by competition have now reduced the losses so that in the larger houses every possible by-product is sought. However, organic material escapes with floor washings both as suspended matter or solution. In the treatment of these liquid wastes the activated sludge process appears particularly promising.

The character of the raw sewage varies with the local conditions. The experiments of the Sanitary District have been conducted on a mixed domestic and packinghouse sewage (Centre Avenue sewage) containing by volume perhaps 25 per cent. of domestic sewage. The experiments of the packers have been conducted on the effluent from individual houses, containing considerably higher amounts of suspended matter as well as organic matter in solution.

The activated sludge plant originally consisted of a rotary screen, four tanks in which the sewage is aerated, one tank for settling the aerated sewage, one sludge storage tank, two blowers with motors for supplying air, a sludge pump for returning the sludge to the aeration tanks from the settling tank, or the sludge storage tank, and a Venturi meter with recording apparatus for determining the quantity of air used.

The rotary screen is of the Weand type, cylindrical in shape, 2 ft. 4 ins. diameter by 4 ft. 8 ins. long, covered with 30-mesh brass wire screen, supported on ½-inch mesh screen. In the summer of 1917, the 30-mesh screen was replaced by a 20-mesh.

The four aeration tanks are each 6 x 23 ft. in plan, 12 ft. deep, inside dimensions, of 3-inch Oregon fir, well bolted together, with air distributors of filtros plates set in hopper bottoms of concrete faced with hollow tile. The plates are arranged differently in each pair of tanks. The ratio of plate area to tank area is approximately 1 to 6.3 in both the tanks with one row of plates down the centre and those with the rows transversed to the length of the tank. After remodelling, the effective plate area was found to be 1 to 8. The capacity of each tank is about 11,000 gallons to the flow line. The tanks were first connected in series and provided with inlet and drain pipes, so that they can be operated separately on the fill-and-draw plan, as well as a whole with continuous flow. The air system is arranged with a main header to each tank, from which branch pipes feed each set of plates. Three small Venturi meters are provided to set on the main header lines in a by-pass to check up the flow of air to each tank.

Summary of Activated Sludge Results

The Sanitary District experiments (2) on the activated sludge up to March, 1917, have shown that the following conditions must be met:—

---

*Abstract of paper read before the American Public Health Association, October 18th, 1917.

1. The sewage should be screened with a fine mesh screen; 30-mesh has been used. This removes from 600 to 1,000 pounds of dry material per million gallons of day flow.

2. The screened sewage can be aerated in continuous flow tanks using 4 cubic feet of air per gallon of sewage, with an 8-hour contact period of sewage and activated sludge. This will produce an effluent, practically stable in summer conditions.

3. Sufficient sludge storage capacity in the aeration tanks should be provided to care for at least 140 per cent. of the sewage entering the tanks. Actually from 40 to 80 per cent. of the incoming flow is returned from the settling tanks, as a mixture of sludge and sewage.

4. The depth of the tanks has been taken at 16.5 feet over the plates. The air distribution proposed is through filtros plates set in unit boxes of cast-iron, the ratio of filtros plates to the superficial area of the tank is 1 to 6.

5. The system provides the following approximate recovery of solids: Grease as scum, 360 pounds per million gallons of day flow; sludge, 2,000 to 3,000 pounds screenings, 600 to 1,000 pounds of dry material per million gallons of dry flow; sludge, 2,000 to 3,000 pounds of dry material per million gallons.

Air Distribution

The distribution of the air appears at present to be best served by the use of filtros plates. Perforated pipes have been tried both at Chicago and Fort Worth. More air is required than with the filtros. The ratio of gross area of plate to tank area at Chicago was 1 to 6.3 with net area of 1 to 8. At Fort Worth, 1 to 7 has been used.

Tank Design

Considerable study is required on both domestic and industrial sewage to determine the best design of tanks. In this connection the design of the bottom of the aeration tanks deserves attention. In England, Jones and Attwood have worked out a saw-tooth design. In the United States, Mordell, at Milwaukee, has worked out a design with a curved bottom, the plates being placed eccentric to the centre of the tank. At the Chicago testing station simple baffling has been tried, with different arrangements of shallow hoppers in the bottom. No directly comparable results are available.

Sludge Treatment

The handling of the sludge is probably the most knotty problem of all. In the Sanitary District work, with screened sewage, exclusive of screenings, about 46,500 gallons of liquid sludge, containing 99.2 per cent. water accumulated per million gallons of sewage over a period of nine months. This is equivalent to 2,420 pounds of dry solid per million gallons. The amount of dry solids per million gallons appear to vary between 1,100 and 4,500 pounds exclusive of screenings. The screenings caught on a 30-mesh screen will vary from 500 to 1,200 pounds of dry material per million gallons of day flow. During a period of 6.5 months the reduction of suspended matter was 2,820 pounds as against a sludge removal of 2,680 pounds of dry material per million gallons.

The essential point is to remove the water. Various expedients have been tried, which may roughly be subdivided into (1) settling; (2) the use of coagulants, including both alkali and acid; (3) filter pressing.

With very liquid sludge, direct filter pressing is difficult, owing to the large amount of liquid to be handled. Preliminary treatment by settling with or without acidification is very helpful. Quiescent settling from 3 to 6 hours will reduce the moisture content to 98 or 98.5 per cent. The addition of about six pounds of sulphuric acid per thousand gallons of sludge (containing 98 per cent. moisture) seems to aid in filter pressing, and makes a sludge which leaves the cloths cleaner. A 2.5-hour pressing with acid-treated sludge is equivalent to 3½ to 4-hour pressing with settled sludge. Moreover, acid-treated sludge apparently keeps better and shows a somewhat higher nitrogen content.

The effect of acid on activated sludge is not at all the same in different places. Apparently on the Sanitary District sludge, the effect of acid is a minimum, whereas at Fort Worth, on packinghouse activated sludge, the addition of acid produces a rapid coagulation, with immediate flotation of the sludge, the moisture content being quickly reduced. The water used in the packinghouses there is very high in alkali. The sludge can be further reduced by drainage and re-treating to about 85 per cent. moisture or lower. This phenomena does not occur at Chicago. Furthermore, it is estimated at Fort Worth that about 11,000 pounds of dry material can be recovered per million gallons.

Sludge Analyses

There appears to be considerable fertilizer value in activated sludge. Analyses show a high nitrogen content, compared to the screenings. Occasional analyses show press cake, particularly with acidified sludge, running from 5 to 6 per cent. of nitrogen on the dry basis.

Cost of Plants

The exact cost of plants for handling packinghouse wastes have still to be determined. Approximate estimates made by W. D. Richardson and the author for the conditions in Chicago (2) are subject to revision as better data is obtained, particularly in the costs of handling the sludge. As yet, no large-scale plant has been operated as a complete unit. For the 50-million-gallon daily plant, the first cost, exclusive of land, was estimated at $3,752,000. The annual cost, including interest, depreciation, and operating charges, was estimated at $822,000, of which $270,000 was for electric power. The power was figured on a sliding scale which averaged about 0.7 per cent. per killowatt-hour. Including power, the annual operating charge was estimated at $455,700.

Conclusion

The activated sludge process offers the best promise of a solution of the problem of treating packinghouse waste of any suggested up to the present time. For the study of conditions in Chicago the construction of a unit plant has been recommended to handle 1.5 million gallons per day.

At the recent convention of the Chamber of Commerce of the United States at Atlantic City, resolutions regarding the prompt improvement of the country's public highways were adopted unanimously.

A concession has, it is said, been granted to Don Miguel Otamendi for the construction and working, for a period of 90 years, of an underground electric railway system in the Spanish capital, to be known as the "Metropolitan de Madrid Alfonso XIII." There will be four sets of metals. The capital necessary for the construction of the complete system, embracing a total distance of 14 kiloms. (8¾ miles) is rather over $5,000,000. A period of eight years will be allowed for the completion of the undertaking. The first line to be constructed will cross the city from north to south; it will be 4 kiloms. (2½ miles) long, and is estimated to cost upwards of $1,500,000. Work is to be commenced shortly, and this section must be completed within three years.

COMPARISONS OF VARIOUS BY-LAWS COVERING FLAT SLAB CONCRETE BUILDINGS WITH ACTUAL TESTS

(Concluded from last week's issue.)

Pittsburgh By-law

The third by-law considered will be that of Pittsburgh, extracts of which follow:

REQUIREMENTS

Stresses: All unit stresses shall be as specified in the ordinance governing the use of concrete and reinforced concrete. The resisting moment and coincident stresses shall be computed under the assumptions set forth in the ordinance.

Moments: The negative bending moment at the support shall be taken $\frac{W'L'}{11}$, in which W' equals the total load on one panel exclusive of any load within the area of the column capital, and L' is the clear span between column capitals measured along the side of the panel.

The positive moment at the centre of the panel shall be taken as $\frac{WL}{16}$, in which W is the total load on a panel and L the distance centre to centre of columns measured along the side of the panel.

Resisting Sections: The negative moment at the support shall be considered as acting on a vertical section passing through the slab along the periphery of the column capital. The compressive stress in the concrete on this section shall be calculated by the ordinary straight-line assumptions of stress distributed, by the formulæ given in the ordinance, taking the periphery of the column capital as the width of the section and the depth from the lower face of the concrete adjoining the column capital to the centre of gravity of the slab steel as the depth of the section.

The area of slab steel resisting the negative moment of $\frac{W'L'}{11}$ at the support shall be taken as the total section of all slab rods cutting a conical critical section starting at the periphery of the column capital and flaring outwards at a 45 degree angle with the vertical. The spacing of rods thus determined for the width of the critical section shall be maintained for the full width of the bands.

The positive moment at the centre shall be resisted by the steel and concrete cut by a vertical critical section through the slab having its centre at the column centre and its diameter equal to the main dimension of the sides of the panel.

Drop Construction: The thickness of the slab adjacent to the column capital may be increased, if necessary, by means of a depending concrete drop panel centered on the column centre. Where this drop panel is used the resisting moment of the slab at the periphery of the drop shall be not less than calculated from the formula $W' \frac{L'}{11} \frac{X^2}{2L'} \frac{X}{2}$ in which W' and L' are as defined above and X is the distance between the edge of the column capital and circle of area equal to that of the drop used. This drop panel may be diminished in thickness at greater distance from the column capital if desired, provided the resisting moment at any section shall not fall below the value determined by the above formula applied to that particular section.

Referring to this by-law it will be noted that the bending moment at the column capital is considered to act in a radial direction. The resisting concrete is assumed to be that cut by a vertical plane through the circumference of the column capital. If the diameter of the capital is taken as 2/10 L, in accordance with the Philadelphia by-law, the circumference becomes equal to ⅝ L and therefore the width of the resisting concrete for one band is 5/32 L (for the two-way system).

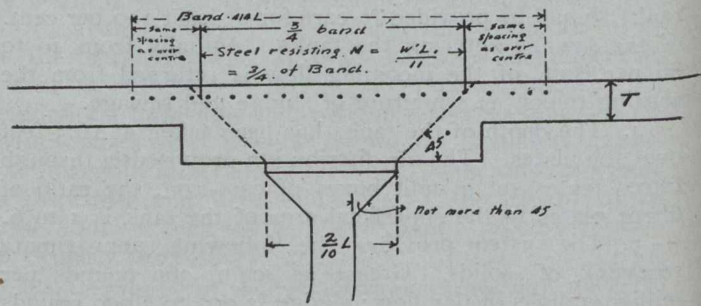


Fig. 5.

By referring to Fig. 5 it will be noted that only ¾ of a band of steel may be considered as resisting the negative moment.

The total negative bending moment at the support is given in this by-law as $\frac{W'L_1}{11}$, assuming diameter of capital $= \frac{2}{10} L$, as before, then $L' = \frac{8}{10} L$ and $W' = \frac{97}{100} W$ and total negative bending moment at support $= \frac{8}{10} \times \frac{97}{100} \times \frac{W'L_1}{11} = \frac{776}{11{,}000} WL$ ft.-lbs. $= \frac{WL}{14.2}$ ft.-lbs., approximately.

This is resisted by four partial bands of steel.

$\therefore -Mr_1 = \frac{WL}{57}$ and is resisted by ¾ band of steel, and ¼ of the circumference of the column cap by the thickness of the concrete.

Referring again to the test.

$$-Mr_1 = \frac{36{,}352 \times 16 \times 12}{57} \text{ in.-lbs.} = 122{,}450 \text{ in.-lbs.}$$

This is resisted by ¾ of 4 sq. ins. = 3 sq. ins.

$$\therefore s = \frac{122.450}{3 \times 6.6} = 6{,}184 \text{ lbs. per square inch.}$$

This is about four times that given by reading No. 140 in the test, which was 1,500 lbs.

Now, ¼ of the circumference of the column cap is

$$\frac{1}{4} \times 2 \times \frac{22}{7} \times \frac{1}{10} L = \frac{5}{32} L$$

$\therefore$ for the compression stress in the concrete, we have (see Fig. 1):

$$\frac{c}{2} \times 2.7 \times \frac{5}{32} \times 16 \times 12 \times 6.6 = 122{,}450 \text{ in.-lbs.}$$

$$\therefore c = \frac{122{,}450 \times 2}{2.7 \times 198} = 458 \text{ lbs. per square inch,}$$

which is about five times the stress given by reading No. 12, which is 90 lbs.

Or taking the actual size of the capital for the case under consideration (3 ft. 6 ins. diameter):

The bending moment for ¼ of the circumference of cap is $\frac{1}{4} \times \frac{W'L_1}{11} = \frac{1}{4} \times \frac{(36{,}352 - 1{,}367)\ 12\frac{1}{2} \times 12}{11}$

$$= \frac{34,985 \times 12\frac{1}{2} \times 12}{44} = 119,268 \text{ in.-lbs.}$$

$$\frac{c}{2} \times 2.7 \times \frac{22}{7} \times 42 \times \frac{1}{4} \times 6.6 = 119,268$$

$$\therefore c = \frac{119,268 \times 2}{2.7 \times 33 \times 6.6} = 406 \text{ lbs. per square inch, which}$$

is about 4½ times that given by reading No. 12.

The total positive moment at the centre of the panel is given as $\frac{WL}{16}$ and is resisted by all steel and concrete cut by a vertical plane through the circumference of a circle whose diameter is equal to L, and whose centre is at the centre of the column.

For the positive moment resisted by one straight band, A, and one centre band, B, (which would be a summation of Mb and Mc for the Chicago and Philadelphia by-laws) the bending moment will be $\frac{WL}{64}$.

Then, $\frac{WL}{64} = \frac{36,352 \times 16 \times 12}{64} = 109,056$ in.-lbs.

and $s = \frac{109,056}{(2.75 + 1.32)\ 4.62} = 5,801$ lbs. per square inch (see Fig. 4) which is more than four times what is given by test. (See reading No. 7.)

Joint Committee Report

The report of the Joint Committee on Concrete and Reinforced Concrete will now be considered.

The negative moment for the width of an interior square panel is taken as $-\frac{wL}{15}(L - \frac{2}{3}c)^2$ where c is the diameter of the column capital.

If $c = \frac{2}{10}L$ this becomes $-\frac{169}{3,375}wL^3 = -\frac{wL^3}{20}$, approximately; $= -\frac{WL}{20}$, approximately.

Twenty per cent. of this moment $= -\frac{WL}{100}$ is to be provided for in the mid-section. This corresponds to the negative moment in strip B of the Chicago by-law.

For slabs having drop panels, 80% of the moment $= -\frac{WL}{25}$ is to be provided for in the two column-head sections of the panel; i.e., the negative moment in strip A of the Chicago by-law would be $-\frac{WL}{25}$ by the Joint Committee report.

For slabs without drop panels 65% of $-\frac{WL}{20} = \frac{WL}{31}$, approximately, is taken as the negative moment in strip A.

The positive moment for the width of an interior square panel is taken as $\frac{wL}{25}(L - \frac{2}{3}c)^2$, which becomes $\frac{WL}{33}$, approximately, when $c = \frac{2}{10}L$.

Twenty-five per cent. of this moment $= \frac{WL}{133}$ is to be provided for in the inner section corresponding to strip B of the Chicago by-law.

For slabs having dropped panels 60% of the moment $\frac{WL}{33} = \frac{WL}{55}$ is to be provided for in the two outer sections, which together correspond to strip A of the Chicago by-law, and the thickness of slab away from the dropped panel is to be determined by using 70% of $\frac{WL}{33} = \frac{WL}{47}$, approximately

For slabs without dropped panels 55% of $\frac{WL}{33} = \frac{WL}{60}$ is to be provided for in strip A.

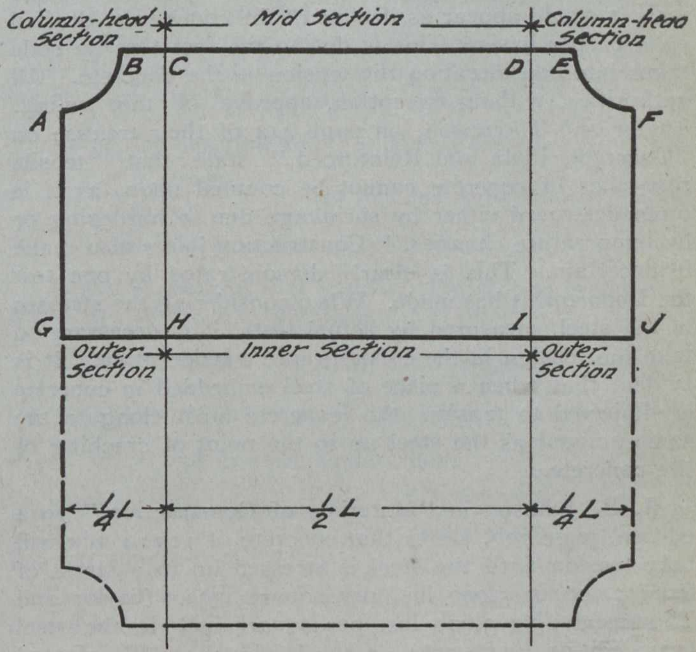


Diagram C (Joint Committee Report)

The negative moment in strip A would then be $-\frac{36,352 \times 16 \times 12}{25} = 279,000$ in.-lbs.

Referring to Fig. 1. The computed stress in the steel is $\frac{279,000}{4 \times 6.6} = 10,570$ lbs. per square inch, which is about seven times as great as that given by reading No. 140.

The computed compression stress in the concrete will be 326 lbs. per square inch, which is about 3.6 times as great as that given by reading No. 12.

The positive moment in strip A would be $\frac{W_L L}{55}$ $= \frac{36,352 \times 16 \times 12}{55} = 126,900$ in.-lbs. and the computed stress in the steel $= \frac{126,900}{2.75 \times 4.84} = 9,520$ lbs. per square inch (see Fig. 2), which is 6.7 times that given by reading No. 7.

The negative moment in strip B $= -\frac{W_L L}{100} = \frac{36,352 \times 16 \times 12}{100} = 69,700$ in.-lbs. and $s = \frac{69,700}{1.32 \times 4.4}$ $= 12,000$ lbs. per square inch (see Fig. 3), or about 23 times that given by reading No. 132.

$c = \frac{69,700 \times 2}{1.8 \times 96 \times 4.4} = 183$ lbs. per square inch. (See Fig. 3.)

Reading No. 16 gives 203 lbs. per square inch as the stress in the concrete.

The positive moment in strip B is $\frac{WLL}{133} = 52,500$ in.-lbs. and $s = \frac{52,500}{1.32 \times 4.62} = 8,600$ lbs. per square inch (see Fig. 4), which is 2.8 times that given by reading No. 1 and more than 8 times as great as reading No. 2.

Discussion of the By-laws

From a comparison of the different by-laws with the tests it would appear as if none of the codes were drafted on a proper basis. This is due to the fact that no code takes into consideration the tension in the concrete. All authorities, without exception, approve of this ruling. Taylor and Thompson, on page 414 of their treatise on "Concrete, Plain and Reinforced," state that "tensile resistance of concrete cannot be counted upon, as it is often destroyed either by shrinkage due to hardening or by temperature changes." Construction joints also make it uncertain. This is clearly demonstrated by one test the Department has made. When considering the stresses in the steel, measured by actual tests, it is necessary to take the tension in the concrete into consideration. It is evident that when a piece of steel embedded in concrete is subjected to tension the concrete must elongate the same amount as the steel up to the point of cracking of the concrete.

J. B. Johnson in "Materials of Construction," 1914 edition, page 72b, states that concrete of 1:2:4 mix will take tension until the steel is stressed up to a stress of from 2,000 to 5,000 lbs. per square inch. Taylor and Thompson give 3,600 lbs. per square inch in the steel (1916 edition, page 407). Geo. H. Hool in "Reinforced Concrete Construction," Vol. I., p. 52, verifies this also.

On examining the tests, it will be noted that, for the 142 lbs. live load, in no case has the steel been stressed up to these figures, including the stress due to the dead load, which, as mentioned before, is about 4/7 as great as that given for the live load stresses. On account of this fact, this discussion has been confined to the tests for the 142 lbs. per square foot live load, so that the actual resisting moment could be arrived at due to there being no cracks in the concrete. Thus if the moment of inertia and section moduli of the section are found after substituting for the steel the equivalent area of concrete, then the extreme fibre stresses of the concrete in tension and compression may be computed. (See "Materials of Construction," by Johnson, p. 72.)

Following up the idea given above, the neutral axis of strips A and B have been computed for their theoretical and actual position at the time the readings were taken. It will be noted that in no case does the theoretical position agree with the actual position of the neutral axis. (This point is carefully discussed in Taylor and Thompson, page 411, and it will not be touched on here.) The actual position of the neutral axis, according to test, has been taken in computing the moments of inertia of the sections.

For the floor slab in question:

E_s = modulus of elasticity of steel = 30,000,000.

E_c = modulus of elasticity of concrete in compression = 3,000,000 to 3,500,000.

E_t = modulus of elasticity of concrete in tension = 2,400,000 to 2,800,000 on the assumption that $E_t = 8/10\ E_c$, which is given by most authorities.

C = compressive strength of concrete per square inch = 3,900 lbs. by test of material used at the job.

C_t = tensile strength of concrete per square inch.

"Materials of Construction," by J. B. Johnson, gives $C_t = 1/12\ C$, and "Masonry Construction," by Ira O. Baker, gives C_t from 1/6 to 1/12 C when the compressive strength is determined by crushing cubes. This ratio seems to be independent of the proportion or the age. (See page 204, bottom paragraph, 1913 edition. Also see page 202, Table 36, which gives the tensile strength of concrete of 1:2:4 mix as 228 lbs. per square inch—average of five tests.)

If C is 3,900, then $C_t = 1/12\ C = 325$ lbs., which seems rather high.

A = area of steel per unit width.

Q_c = section modulus, compression side.

Q_t = section modulus, tension side.

λ_c = deformation of concrete in compression × 5,000.

λ_t = deformation of concrete in tension × 5,000.

λ_s = deformation of steel × 5,000.

Minus sign (—) indicates compression. Plus sign (+) indicates tension.

NOTE: The readings given in Tables Nos. 4 and 4A are 5,000 times as large as actual deformation as the extensometer used multiplied the deformation by 5,000.

Also, the deformations are for a distance of 8 inches, so for actual unit deformations figures given should be divided by 40,00.

EXTENSOMETER READINGS OF DEFORMATIONS CAUSED BY LIVE LOADS.

Floor.

GAGE LINE	142# ON 4 PANELS	300# ON 4 PANELS	300# ON 2 PANELS	LOAD REMOVED	GAGE LINE	142# ON 4 PANELS	300# ON 4 PANELS	300# ON 2 PANELS	LOAD REMOVED
101	+1.9	+1.5	+2.0		133	-2.4	-4.5	-1.5	-0.2
102	+3.4	+3.9	+3.6	+1.8	134	-3.0	-4.1	-0.9	0.0
103	+2.7	+5.0	+7.6	+5.9	135	-2.8	-3.5	-0.6	-0.2
104	+2.2	+2.9			136	-2.8	-3.5	-1.7	+1.0
105	+2.1	+3.1	+2.9		137	+1.2	+2.4	+2.6	+0.4
106	+1.3	+4.0	+2.9		138	+0.6	+1.0	+0.2	+0.2
107	+1.6	+4.4	+2.3		139	+0.5	+1.8	+1.6	+1.2
108	+0.2	+1.4	+1.1		140	+2.0	+3.7	+3.2	+0.1
109	0.0	+1.8	+0.1		141	+1.5	+4.8	+4.0	+2.1
111	+5.3	+6.5	+2.4		142	+0.4	+1.8	+0.9	+0.6
112	+1.6	+3.9	+2.8		143	+0.2	+1.4	+0.3	+0.4
113	+1.8	+0.9	+3.8	+1.2	144	+1.0	+1.8	+1.1	-0.5
114	+3.5	+5.7	+4.9	-0.2	145	+0.7	-1.2	-4.4	-2.8
118	+0.4	+2.7	+4.6	+2.2	146	+2.3	+2.9	+2.9	0.0
119	+0.2	+3.8	+3.1	+2.9	147	+3.0	+3.3	+3.9	+3.1
121	+1.8	+4.5	+4.8	+2.5	148	+3.9	+8.6	+9.0	+4.3
122	+2.6	+4.9	+4.6	+1.2	149	+3.3	+3.3	+3.2	-0.2
123	-2.1	-3.2	-4.3	-1.4	150	+2.0	+3.4	+3.1	+2.0
124	+0.8	+2.8	+2.6	+1.8	151	+2.6	+4.5	+5.4	+3.7
125	+1.4	+3.8	+4.0	+3.8	152	+2.5	+3.1	+3.9	+2.0
126	+0.6	+3.7	+3.4	+3.3	153	+3.5	+4.4	+4.7	+3.6
127	-0.4	+4.7	+4.6	+0.9	154	+1.5	+1.8	+1.8	-1.2
128	-3.5	-3.6	-4.2	-0.7	156	+1.9	+7.3	+9.1	
129	-4.9	-4.5	-6.0	-2.0	157	+2.2	+7.1	+6.6	
130	-0.9	-2.4	-3.4	+0.1	158	+0.5	+1.5	+3.1	
131	-3.0	-5.4	-6.4	-1.3	160	+1.0	+2.2	+4.8	+1.8
132	+0.7	+0.7	-0.1	-0.1	161	+1.2	+1.4	+2.2	0.0

+ = Tension. — = Compression.

Note. Deformation readings are multiplied 5000 times.

Table 4

Referring to Section 1-1 and assuming the section to be divided into strips similar to those of the Chicago Code, the moment of inertia of the section shown in Fig. 6 may be found, using the actual neutral axis as plotted from deformations.

I = 10,457 (using actual N.A. found by test).
Q_c = 3,485 " " " " "
Q_t = 1,608 " " " " "

EXTENSOMETER READINGS OF DEFORMATIONS CAUSED BY LIVE LOADS.

Ceiling

GAGE LINE	142# ON 4 PANELS	300# ON 4 PANELS	300# ON 2 PANELS	LOAD REMOVED	GAGE LINE	142# ON 4 PANELS	300# ON 4 PANELS	300# ON 2 PANELS	LOAD REMOVED
1	+4.1	+10.1	+7.8	+6.1	35	−2.8	−2.9	−4.7	−2.7
2	+1.4	+7.8	+7.4	+6.5	36	−1.3	−3.8	−3.2	−2.8
3	−0.4	+6.3	+3.2	+5.4	37	−0.7	−2.1	−2.4	−1.2
4	+1.1	+12.2	+10.6	+8.9	38	−3.9	−5.9	−6.8	−5.2
5	−0.9	+8.1	+5.2	+4.1	39	−0.6	+3.4	+4.1	+0.1
6	−1.0	−1.1	−0.4	−0.8	40	−0.7	+2.4	+4.1	+1.3
7	+1.9	+15.2	+11.3	+10.3	41	+2.0	+4.7	+5.3	+1.8
8	−0.3	+3.5	+1.6	+1.2	42	−0.9	+3.0	+5.1	+1.7
9	−0.8	+0.4	−0.1	−0.1	43	+0.9	+4.7	+7.0	+4.3
10	−2.5	−2.9	−1.7	−1.8	44	−0.9	+1.1	+1.0	+0.1
11	0.0	−0.7	0.0	0.0	45	0.0	+1.5	+1.6	+0.7
12	−1.2	−0.4	−0.1	−1.2	46	−1.1	−0.4	−1.6	−2.1
13	−1.4	−1.0	−1.9	−1.9	48	+1.0	+2.8	+2.7	+0.1
14	−3.7	−4.9	−5.3	−2.9	49	−1.4	−2.8	−1.9	−1.9
15	−3.1	−5.0	−4.4	−2.7	50	−2.7	−3.4	−3.8	−3.6
16	−2.7	−3.8	−4.2	−3.8	51	−4.0	−4.3	−3.8	−4.0
17	+0.1	+5.9	+5.8	+2.9	52	−4.8	−4.8	−5.2	−5.1
18	−2.0	−1.0	−1.0	−1.4	53	+0.4	−0.7	0.0	0.0
19	−1.3	−3.4	−3.4	+0.1	54	−1.5	+0.5	+1.7	−0.6
20	−2.7	−5.3	−5.8	−1.9	55	+1.4	+2.9	+3.7	+1.6
21	−3.3	−5.1	−6.2	−2.2	56	+2.6	+4.4	+4.4	+1.9
22	−3.4	−4.6	−4.9	−3.0	57	+0.4	+2.0	+2.6	+0.2
23	+0.2	+1.3	+1.2	+1.0	58	−1.8	−2.6	−3.2	−2.7
24	−4.8	−1.7	−1.1	−0.8	59	−0.8	−3.2	−3.2	−1.1
25	−0.9	−1.6	−2.7	−1.2	60	−1.7	−3.8	−4.2	−1.5
26	−1.2	+3.1	+4.7	+0.3	61	−3.5	−7.8	−6.6	−4.3
27	+2.4	+5.4	+5.5	+2.0	62	−1.0	−5.0	−5.3	−3.2
28	+1.1	+2.2	+2.5	0.0	63	0.0	−1.1	−0.9	−0.8
29	+3.0	+5.9	+6.7	+2.2	64	−4.0	−7.2	−5.1	−1.9
30	−2.1	−3.6	−4.5	+0.1	65	+0.3	−2.2	−2.6	+1.6
31	−0.9	−1.4	−1.7	+0.1	66	−1.0	−1.4	−2.1	0.0
32	−2.8	−8.0	−8.7	−5.3	67	−0.7	−2.2	−3.6	−2.5
33	−3.8	−5.3	−5.7	−3.6	68	−1.4	−1.9	−2.8	−1.8
34	−1.6	−1.5	−1.5	−0.4	69	−1.7	−3.8	−2.4	−2.2

+ = Tension — = Compression

Note. Deformation readings are multiplied 5,000 times.

Table 4A

Referring to Fig. 6a, it will be seen that $\lambda_c = 1.9$ and $\lambda_t = 4.0$. These have been found from reading No. 12 and the average of readings Nos. 140 and 141 (Tables 4 and 4A) by assuming that the deformation due to the dead load is proportional to the deformation due to the live load.

Then, using the Chicago Code:

$$M_r = -\frac{WL}{30} = 364{,}800 \text{ in.-lbs.}$$

$$\therefore \quad \frac{M_r}{Q_c} = \frac{364{,}800}{3{,}485} = 105 \text{ lbs. per square inch compression in extreme fibre of concrete.}$$

and $$\frac{M_r}{Q_t} = \frac{364{,}800}{1{,}608} = 228 \text{ lbs. per square inch tension in extreme fibre of concrete.}$$

Referring again to Fig. 6a it will be noticed that $\lambda_c = 1.9$. $\therefore c = \frac{1.9 \times 3{,}000{,}000}{40{,}000} = 142$ lbs. per square inch compression in extreme fibre of concrete, which is 37 lbs. more than that obtained by using the section modulus which gives 105 lbs. per square inch.

Using the deformation $\lambda_t = 4.0$ we have

$$c_t = \frac{4 \times 2{,}400{,}000}{40{,}000} = 240 \text{ lbs. per square inch tension in extreme fibre of concrete.}$$

It will be noticed that by using the section modulus a stress of 228 lbs. was obtained.

The stress in the steel may now be found as follows:

$$c'_t = \text{tension in concrete at steel level} = 228 \times \frac{4.5}{6.5} = 158 \text{ lbs. per square inch.}$$

Then s = tension in steel $= \frac{158 \times 30{,}000{,}000}{2{,}400{,}000} = 1{,}980$ lbs. per square inch.

Comparing this stress with that computed from actual deformation we get:

$$s = \frac{2.76 \times 30{,}000{,}000}{40{,}000} = 2{,}080 \text{ lbs. per square inch}$$

tension in steel, according to test, or just 100 lbs. per square inch greater than that obtained by using section modulus.

Referring to Fig. 7a it will be noticed that $\lambda_t = 2.75$

$$\therefore \quad c_t = \frac{2.75 \times 2{,}400{,}000}{40{,}000} = 165 \text{ lbs. per square inch}$$

tension.

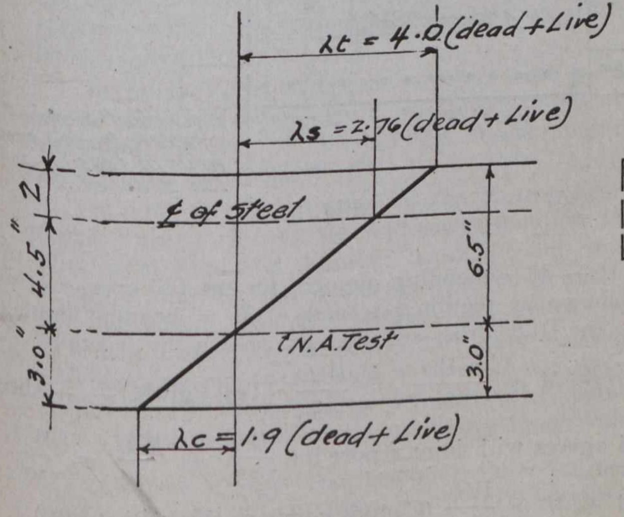


Fig. 6a.

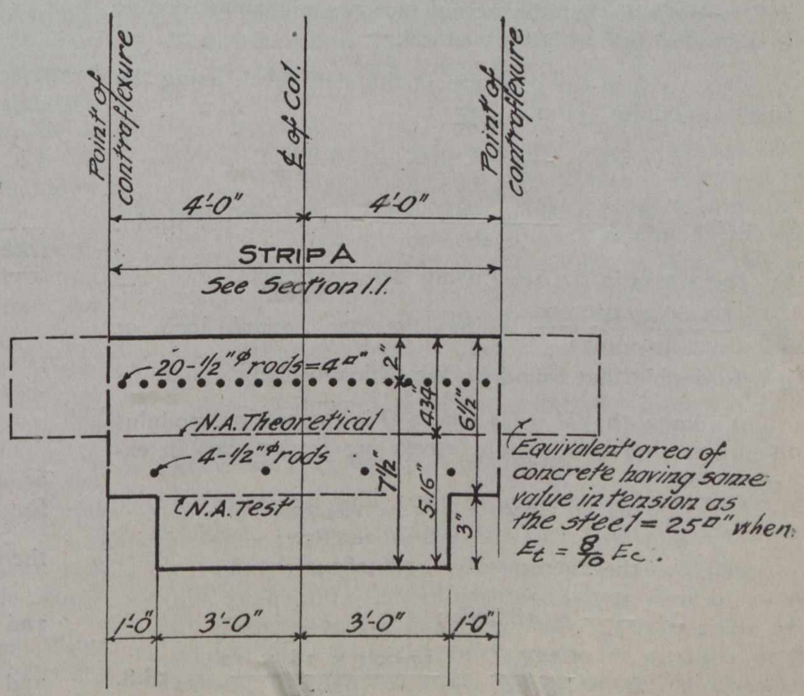


Fig. 6.

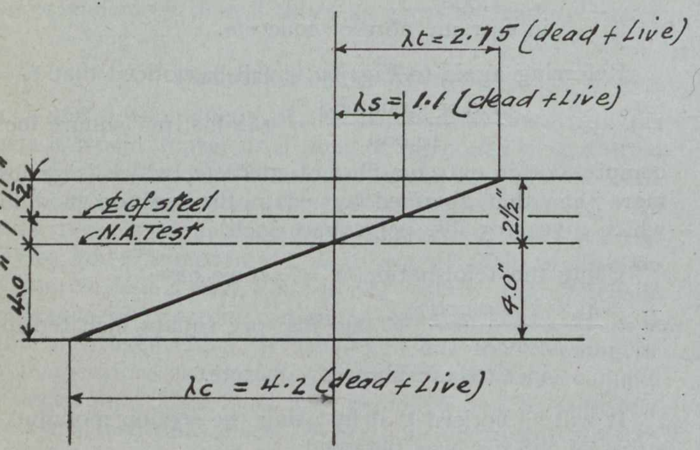


Fig. 7A.

The deformation for the compression side was 4.2,

$$\therefore \; c = \frac{4.2 \times 3{,}000{,}000}{40{,}000} = 316 \text{ lbs. per square inch}$$

compression.

Using the actual position of the neutral axis (see Fig. 7) the moment of inertia was found to be 2,567. Qt = 1,026 and Qc = 642.

Using the Chicago Code, then,

$$Ms = \frac{WL}{120} = 91{,}750 \text{ in.-lb.}$$

$$\text{Then, } \frac{Ms}{Qt} = \frac{91{,}750}{1{,}026} = 89\tfrac{1}{2} \text{ lbs. per sq. in. in tension}$$

$$\text{and } \frac{Ms}{Qc} = \frac{91{,}750}{642} = 143 \text{ lbs. per sq. in. in compression.}$$

By comparing the stresses arrived at by the deformation with those found by using the section modulus and the bending moment according to the Chicago by-law it will be noticed that the actual stresses are about double those found by the latter method.

The stress in the concrete at the steel level, using the section modulus, is as follows:

$$c_t = \frac{1}{2.5} \times 89\tfrac{1}{2} = 36 \text{ lbs.}$$

$$\therefore \text{ stress in steel} = \frac{36 \times 30.000{,}000}{2{,}400{,}000} = 448 \text{ lbs. per sq. in.}$$

The stress in the steel using deformation is

$$s = \frac{1.1 \times 30{,}000{,}000}{40{,}000} = 825 \text{ lbs. per square inch, or}$$

nearly double that found by the Chicago Code.

We know that $M = Qs$ where Q is the section modulus of any section and s is the stress per square inch in extreme fibre.

$$\therefore \; Mt = 1{,}026 \times 165 = 169{,}290$$

$$\text{and } Mc = 642 \times 316 = 202{,}872;$$

$$\therefore \text{ the average } M = 186{,}081;$$

$$\therefore \; \frac{WL}{x} = 186{,}081;$$

$$\therefore \; x = \frac{WL}{186{,}081} = \frac{57.000 \times 16 \times 12}{186{,}081} = 58.8.$$

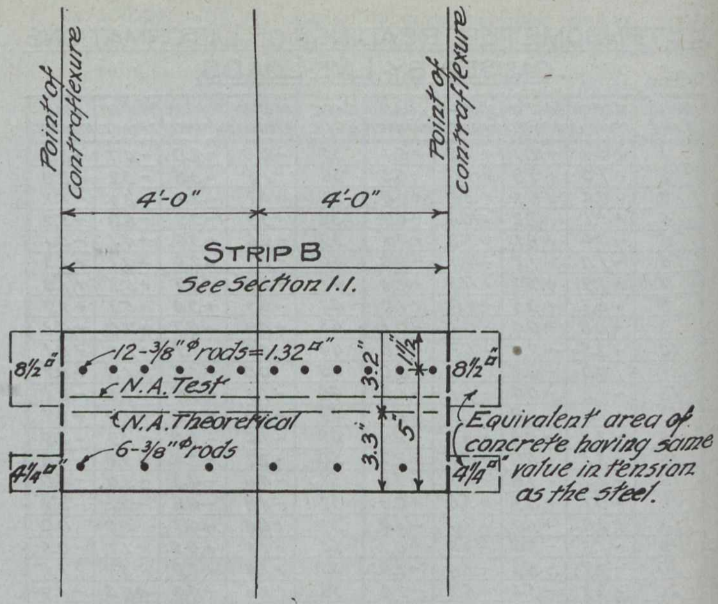


Fig. 7.

Say, $x = 60$,

$$\text{then } Ms = \frac{WL}{60}.$$

$$\text{But } Mr = \frac{WL}{30};$$

$$\therefore \; Ms + Mr = \frac{WL}{20}$$

which is almost the same as if the negative bending moment were taken considering the beam to be of uniform strength and fixed horizontally at both ends and loaded uniformly for its entire length.

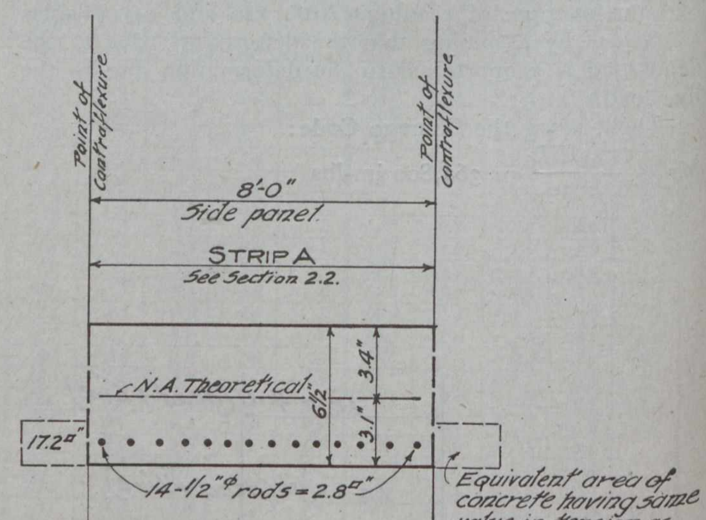


Fig. 8.

If $-M$ = bending moment for the full cross-section, as shown by section 1-1, and $+M$ = bending moment for the full cross-section, as shown by section 2-2,

then $-M = \frac{3\,WL}{64} = \frac{WL}{21.3}$ (Test gives $\frac{WL}{20}$ about and agrees with joint report for $\frac{WL}{25} + \frac{WL}{100} = \frac{WL}{20}$.)

and $+M = \frac{WL}{64}$ (Cannot compare this with tests.)

For a beam of equal and uniform section fixed horizontally at both ends and loaded uniformly its entire length, which is the assumption on which the Chicago Code is based,

$$-M = \frac{WL}{24}$$

$$\text{and } +M = \frac{WL}{48}.$$

Since there is a considerable difference between the readings Nos. 1 and 2 taken at the centre of the slab, and as there is no reading on the concrete to correspond to reading No. 17 at section 2-2, it is hardly practicable to compare the actual to the theoretical stresses across section 2-2.

It would seem from the meagre data before us that $-M = \frac{3\ WL}{64}$ for full section and $+M = \frac{WL}{64}$ would give safer results than the Chicago Code or any of the others considered.

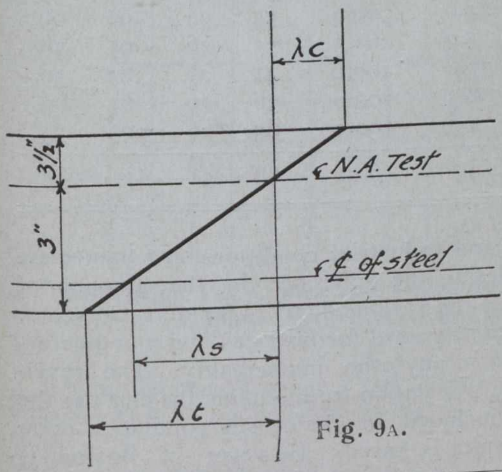


Fig. 9A.

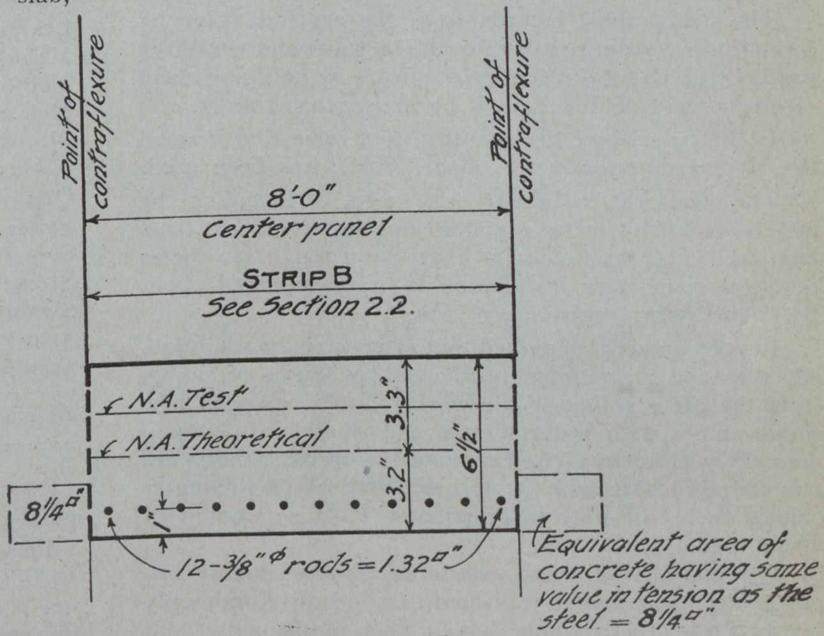


Fig. 9.

RESULTS OF THE USE OF METERS IN THE METROPOLITAN WATER DISTRICT, BOSTON, MASS.*

By Samuel E. Killam

Superintendent, Pipe Lines and Reservoirs, Metropolitan Water Works.

THE Metropolitan Water District at present is made up of the following cities and towns: Arlington, Belmont, Boston, Chelsea, Everett, Lexington, Malden, Melrose, Milton, Nahant, Newton, Quincy, Reserve, Somerville, Stoneham, Swampscott, Watertown and Winthrop. The town of Swampscott was admitted under a special act of the legislature, it being outside of the ten-mile limit prescribed in the act. The city of Newton, which is a part of the district, is still supplied from its own local source.

On January 1st, 1898, the works were so far completed that formal possession was taken of the collecting works of the city of Boston and actual operation and maintenance commenced.

Previous to the formation of the Metropolitan Water District nearly all the cities and towns obtained their supplies from local and different sources and maintained separate pumping units, storage reservoirs and distribution systems. After the Metropolitan Works were put in service eleven sources of supply were abandoned and five pumping plants operated in place of twenty.

Before measurements to determine the quantity and waste could be made it was necessary to provide means for measuring the water supplied to the cities and towns.

In anticipation of the passage of the act, extended studies had been made to determine the number and size of the meters which would be required for measuring the water. The Venturi meter was adopted as the best and most suitable device to measure the large quantities required without too great a loss of head. This meter is a specially designed pipe which contains a contracted section called a throat, which causes a depression in the hydraulic gradient. At the inlet end and at the throat small holes are drilled into the tube, and service pipes which transmit the pressures are connected with the registering instrument which may be located some distance from the tube. Since the meter tube contains no moving parts or obstructions the wear on the interior surface is imperceptible and a throat which was recently removed after seventeen years continuous service was found to be in excellent condition.

There are now sixty-nine meter tubes installed in the district, varying in size from six inches to sixty inches.

The record of flow is recorded at the register and is due to the difference of pressure on the level of a column of mercury, which carries a float. The position of this float is thus made dependent upon the quantity of water passing through the meter and by suitable mechanism the

*Abstract of paper read before the New England Water Works Association Convention, Hartford, Conn., September 13, 1917.

quantity is recorded by counter and the rate of flow recorded on charts. The pressure at the throat of the meter is often several pounds less than at the inlet end but the loss of pressure is nearly all regained at the outlet end of the tube.

There are several types of registers. All have been found to be simple and rugged in construction and responsive to minute variations in rates of flow. There are in use in the district fifty-four type D, five type M and one type V registers.

The autographic records from the registers give information regarding unusual drafts of water and assistance has been given local water departments by notifying them of an increase of flow caused by underground leaks.

In districts where the quantity to be measured is small the Hersey detector meter, model F.M., has been used.

The total cost to January 1st, 1917, of installing the meters, including meter registers and appurtenances, was $94,364. The total cost for charts and repairs to meter registers since their installation in 1903 averaged about $3.50 per meter register per year.

In 1907 an act was passed that after January 1st, 1908, all cities and towns which derived their source of supply from the Metropolitan Waterworks should equip all new service pipes with water meters and should also equip annually with meters 5 per cent. of the services that were unmetered on December 31st, 1907, and should thereafter charge each consumer in proportion to the amount of water used.

The quantity of water consumed became a very important element and it was made an incentive, not only for the District as a whole, but for each municipality, and finally, the most important of all, each consumer, to check and to stop the unnecessary and wasteful consumption of water.

The gradual installation of more service meters in the District has reduced the average daily consumption per inhabitant from 130 gallons in 1909 to 89 gallons in 1916.

The area, population, number of service pipes, meters, and miles of pipe in use in each city and town in the District, are given in the following table:—

City or Town	Area. Sq. Miles	Estimated Population July 1, 1916	Services in Use July 1, 1916	Meters in Use Jan. 1, 1916	Miles of Pipes Jan. 1, 1916
Arlington ..	5.2	15,670	2,753	2,755	45.10
Belmont ...	4.6	8,560	1,430	1,430	29.38
Boston	42.8	762,700	103,195	54,848	849.35
Chelsea ...	2.3	45,020	4,971	4,957	43.30
Everett ...	3.4	38,870	5,893	2,947	50.21
Lexington..	16.0	5,680	1,156	1,063	36.32
Malden	4.9	50,160	8,055	7,696	90.18
Medford	7.1	32,080	6,043	5,846	67.19
Melrose ...	5.1	17,260	4,005	4,211	52.99
Milton	12.9	8,850	1,860	1,926	50.06
Nahant	1.0	1,440	730	468	22.07
Quincy	16.5	42,030	9,315	8,248	129.74
Revere	5.9	26,790	4,413	3,125	52.99
Somerville .	4.2	89,190	13,233	9,155	95.42
Stoneham .	6.6	7,590	1,613	1,589	26.13
Swampscott	3.1	7,580	1,810	1,810	21.99
Watertown.	4.1	17,280	2,798	2,622	38.20
Winthrop..	1.6	13,470	2,903	2,829	32.23
District ...	147.3	1,190,220	176,183	117,525	1,732.85

The per cent. of services metered and the per capita consumption per day and at night in each city and town in the District for the years 1907 and 1916 were as follow:—

City or Town	Per Cent. of Services Metered Jan. 1. 1907	Jan. 1, 1916	Consumption per Capita 1 A.M. to 4 A.M. 1907	1916	Average Daily 1907	1916
Arlington	33.6	100.0	50	28	91	59
Belmont	100.0	100.0	31	18	68	52
Boston	5.5	53.2	107	62	153	105
Chelsea	14.6	99.7	59	35	97	68
Everett	2.0	50.0	50	42	82	74
Lexington ...	2.1	92.0	43	37	69	69
Malden	93.6	95.5	22	28	46	49
Medford	10.5	100.0	65	22	102	46
Melrose	3.9	100.0	85	26	117	45
Milton	100.0	100.0	16	10	46	42
Nahant	17.2	64.1	50	51	130	110
Quincy	14.2	88.6	66	39	100	59
Revere	4.8	70.8	54	34	82	59
Somerville ...	24.6	69.2	55	34	90	69
Stoneham ...	1.9	98.5	55	29	91	58
Swampscott ..	37.8	100.0	41	28	85	59
Watertown ..	98.3	100.0	36	29	67	65
Winthrop ...	2.3	100.0	65	26	105	53
District	14.7	66.8	88	51	130	89

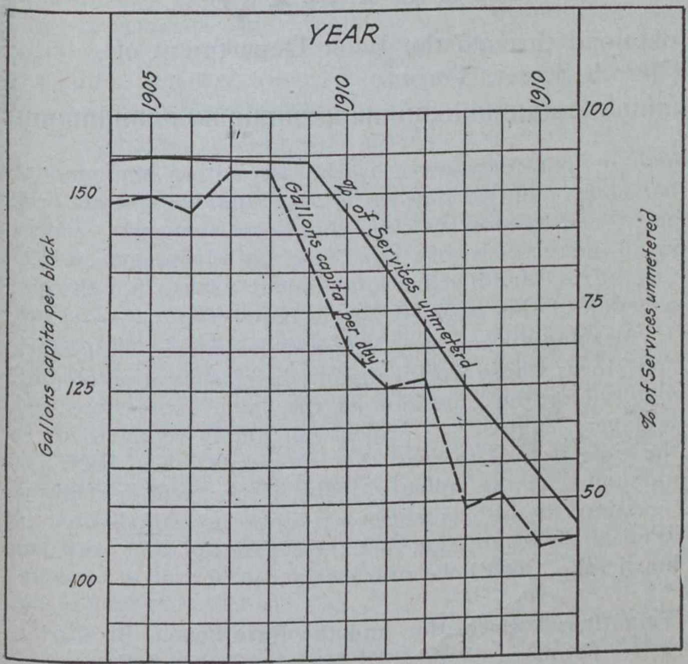
The climatic and industrial conditions are immediate factors in considering the difference in the amount of water consumed in the various districts for different years. In Boston the quantity used for business and manufacturing is larger than in any other municipality. The travelling, or suburban, population from outside the city use the water but is not included in the census population upon which this per capita is based. However, if Boston is divided into various districts, as measured by the master meters, it will be observed that there has been a decided decrease in the per capita consumption in the districts since the installation of service meters.

The following table gives the per capita consumption in gallons for several years in the various districts into which the city of Boston is divided by master meters:—

Districts by Services	1907	1908	1909	1910	1913	1916
Southern Low	148	148	139	128	126	115
Southern High	162	158	151	128	100	105
Charlestown	200	195	186	188	114	113
East Boston	130	140	117	110	58	61
Brighton	132	135	108	107	77	89
West Roxbury	130	131	112	132	92	57
Breed's Island	63	60	61	53	35	31
Total	153	152	143	130	109	105
Per cent. of services metered	5.6	5.7	5.8	12.5	34.8	53.2

The southern low-service district comprises the lower area of the city proper, South Boston, Dorchester and Brighton, in which is located the greater part of the business and manufacturing plants, railroad terminals and electric light and power plants. All the other districts are residential, although the southern high-service includes several of the largest hotels and some business and manufacturing plants. In East Boston and Charlestown considerable quantities of water are used by railroads and shipping, and some by manufacturing plants.

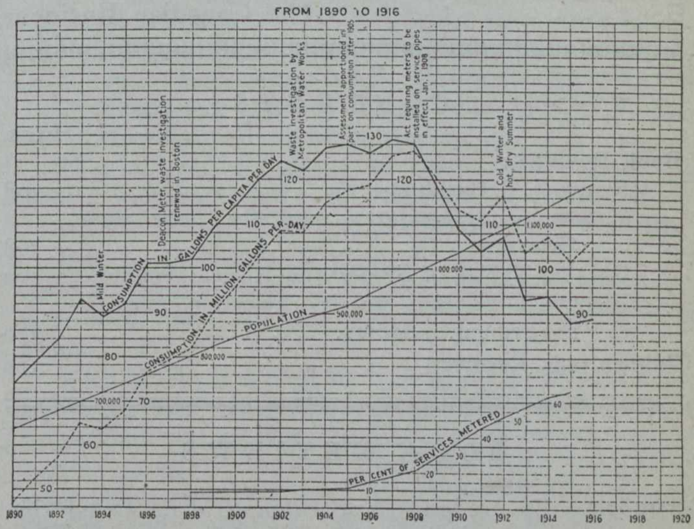
The effect of the use of service meters upon consumption of water is very graphically illustrated by the accompanying diagram showing the daily number of gallons used per capita in the city of Boston and the percentage of unmetered taps for each year, 1904 to 1916 inclusive.



Consumption Per Capita and Percentage of Services Unmetered in City of Boston

There has been a gradual reduction in the quantity of water used with the increase in the use of meters.

The greater the quantity of water used the more it costs in the end to furnish water to the tap. At a fixed rate the consumer is charged a certain sum and naturally is not directly interested in leaky pipes as long as no damage is caused by the water. The leaks increase in volume and the quantity of water required for legitimate



Population, Consumption of Water and Per Cent. of Services Metered in the Metropolitan Water District as Supplied in 1916

use is running to waste. Wasted water means larger mains, more pumping machinery, wasted coal and labor and finally, extension of works for larger supplies and an increased sewer system to care for the wasted water.

City or Town	Population July 1, 1916	Per Capita Consumption, Gallons 1907	1916	Reduction	Equivalent Saving in Gallons per Day	Per Cent of Services Metered Jan. 1, 1907	Jan. 1, 1916
Arlington ...	15,670	91	59	32	501,400	33.6	100.0
Belmont	8,560	68	52	16	137,000	100.0	100.0
Boston	762,700	153	105	48	36,609,600	5.6	53.2
Chelsea	45,020	97	68	29	1,305,600	14.6	99.7
Everett	38,870	82	74	8	311,000	2.0	50.0
Lexington ..	5,680	69	69	..	....	2.1	92.0
Malden	50,160	46	49	+3	150,500	93.6	95.5
Medford	32,080	102	46	56	1,796,500	10.5	100.0
Melrose	17,260	117	45	72	1,242,700	3.9	100.0
Milton	8,850	46	42	4	35,400	100.0	100.0
Nahant	14,040	130	110	20	28,800	17.2	64.1
Quincy	42,030	100	59	41	1,723,200	14.2	88.6
Revere	26,790	82	59	23	616,200	4.7	70.8
Somerville ..	89,190	90	69	21	1,873,000	24.6	69.2
Stoneham ...	7,590	91	58	33	250,500	1.9	98.5
Swampscott .	7,580	85	59	26	197,100	37.8	100.0
Watertown ..	17,280	67	65	2	34,600	98.3	100.0
Winthrop ...	13,470	105	53	52	700,400	2.3	100.0
District	1,190,220	130	89	41	48,799,000	15.0	66.8

The daily average quantity of water used in the District in 1916 was 17,808,000 gallons less than during the year 1908, and the per capita consumption has been reduced from 130 gallons to 89 gallons, equivalent to over 31 per cent. This reduction in the use of water has been accomplished largely by the introduction of service meters.

The above table shows the equivalent saving of 48,799,000 gallons per day in the District if the population of July 1st, 1916, is applied to the reduction of 41 gallons in per capita consumption since 1907.

Many are willing to pay for their own and their neighbors' waste by general taxation but are unwilling to continue to pay for their own waste when presented with a quarterly bill.

The writer believes that water meters are as much a part of a well-operated waterworks system as gas or electric meters are to their respective works. Many gas companies account for 80 per cent. of gas delivered through the master meters. Well-managed waterworks in Europe account for all but 10 per cent. of their supply.

Waste of water can be divided into two classes—leakage from mains, and waste from service pipes. The first can be stopped by efficient management and the latter by enlisting the consumer's co-operation by giving him a direct pecuniary benefit. It appears to the writer that the best way to get results is to sell the water by measure and to keep the measuring devices in good working condition. The writer maintains that the waste which has been stopped in the Metropolitan Water District of Boston by the installation of service meters has deferred for the present the construction of additional works and reduced the cost of maintaining existing works.

The production of cement in Japan has risen from 3,741,000 barrels in 1913 to 3,943,000 barrels in 1915, and the output during 1916 is understood to have been still greater. Five years ago there were practically no exports, but in 1915 upwards of 600,000 barrels were exported, and a considerable trade is being built up in India and in the South Seas.

The Engineer's Library

Any book reviewed in these columns may be obtained through the Book Department of The Canadian Engineer, 62 Church Street, Toronto.

CONTENTS

BOOK REVIEWS

Symbols. By Frederick A. Parkhurst, M.E., Organizing Engineer. Published by John Wiley & Sons, Inc., New York, and Chapman & Hall, Limited, London, Eng.; Canadian selling agents, Renouf Publishing Co., Montreal. 165 pages, 6 x 9 ins., cloth. Price, $2 net. (Reviewed by R. DeL. French, Department of Civil Engineering and Applied Mechanics, McGill University, Montreal.)

In this book, Mr. Parkhurst proposes a sort of industrial esperanto, composed of combinations of letters and figures to represent objects, ideas and operations. As he aptly remarks, "A few characters, suggestive to a marked degree, replace from six to many times six the number of letters which would ordinarily be required to express the same thing." The system was developed primarily for accounting, routing work, etc., in manufacturing establishments, but the principle is adaptable to nearly any purpose. In fact, the author has worked out a code for the use of physicians and surgeons in keeping notes with regard to their cases, and another for the representation of chemical substances.

One advantage claimed for the Parkhurst system is that it is partly mnemonic. For example, all symbols having to do with catalogues have "K" for the key letter. Other instances are "BH" (broach), "GF" (grind fine), "IW" (issue work order) and "SP" scrap. This advantage is perhaps unduly emphasized, as the number of letters or figures which can be memorized is a function of one's natural ability in this direction. The writer of this review, who has a good acquaintance with the Dewey system, has never found it particularly difficult to carry in his head the strings of figures representing, in this decimal system, the ideas of his particular specialty.

Opening the book at random, we find that "LJci, su" means "suppurative cerebral leptomeningitis" and that vanillin or artificial vanilla, or, to give it its chemical name, metamethoxyparaoxybenzoic aldehyde, can be written "ma mTx pax bOk aE," which perhaps suggests the chemical name of this delightful substance better than does its chemical formula, $C_6H_3(CH_3O)(OH)(CHO)$.

The best test of any new idea is the extent to which it is adopted by those who are fitted to judge of its usefulness. Since the Parkhurst system of symbols is now in use in some large industries, it is safe to say that it fills a want. Some such system is no doubt needed when a cent is split forty ways by the accounting staff and the movements of workmen are regulated by written order and timed by stop watch. A uniform system of symbols in all industries is, of course, a great advantage, and this fact offers Mr. Parkhurst abundant excuse for the preparation of this book, if any is required.

Accountants and cost-keepers, draftsmen, filing clerks and others whose work calls for the classification of much material or the repetition of the same expressions, will find here suggestions which will amply repay them for the time needed to read the 155 pages. The book is a monument to the industry of the author, and is really interesting to the casual reader, once he can divorce his mind of the impression that the typesetter went crazy and hopelessly "pied" the manuscript.

Valuation, Depreciation and the Rate Base. By Carl E. Grunsky. Published by John Wiley & Sons, Inc., New York; Canadian selling agents, Renouf Publishing Co., Montreal. First edition, 1917. 387 pages, 27 tables, 6 x 9¼ ins., cloth. Price, $4 net. (Reviewed by H. V. Coes, member of the staff of Gunn, Richards & Co., New York.)

Mr. Grunsky's book "Valuation, Depreciation and the Rate Base" is a valuable contribution to the literature on this important subject. He has rendered a distinct service to the jurist, economist, accountant and engineer in endeavoring to analyze and present supporting facts and decisions anent the attitude of the courts and public service commissions, particularly in the United States, towards public service corporations, in determining what constitutes "reasonable return," and on what this is based, *i.e.*, the "rate base."

The discussion on page nine relative to unprofitable expenditures and early losses is very timely. It is to be hoped that this will clear up some rather loose thinking and the consequent inequitable decisions made in the past by those representing the public.

Mr. Grunsky has patiently striven to overcome confusion arising from the failure to distinguish between amortization, depreciation and replacement.

The writer is in accord with the author's enunciated principles that the "investment in a public utility should remain at all times unimpaired." The possible exceptions might be those utilities based on natural gas, where by reason of the extension of the property it might be desirable to follow a policy of amortization different from the accepted methods, with a consequent sliding scale of rates as a result.

It is to be hoped that this book will aid by its able discussion in converting the courts to the principle of basing rates on the properly invested capital and the volume of business which is transacted rather than "fair value," with all its multifarious shades of meaning and interpretative equivalents.

The chapter on "Essentials of Value" is of more than passing interest. The discussions of the actual and probable life in chapter six, together with the hypothesis advanced, should bring forth the ideas of others. If they do, the author will have rendered a decided service. If they further serve to collect more reliable information and data on this important subject so that tables similar to those of actuaries can be established a measurable advance in the state of the art will have been made. Meanwhile, the author's tables, logical as they seem to the reviewer, will help to bridge the gap.

The chapter dealing with possible procedures in fixing rates should not be construed as an academic discussion. It is the logical expansion of the author's ideas with particular reference to the "unlimited life" method of procedure in establishing values. His statement of the advantages of this method and his graphic comparison of the several methods described in the text should be of particular interest to those engaged in making valuations, and to the courts and rate-fixing bodies. It is hoped that this will assist in determining what is much to be desired —standard practice in this respect. No one, it seems, can dispute the value that standardization of procedure in valuations would have in matters of comparison alone.

In Chapter 12 the author squares the "unlimited life" method with the accepted method of accounting, and makes a strong plea for keeping records and costs so that past financial history can be readily and accurately obtained. The absence of such information, it has been the writer's experience, has made many costly investigations necessary.

In the chapter dealing with the valuation of mines and oil properties, the author brings forth facts and figures to substantiate his argument for a greater interest rate on mining investments. The comparison of methods actually employed in valuations of this class and the comments on same should be of particular value to the student and young engineer, and to those seeking an intelligent understanding of the methods, their application and limits. His bibliography at the end of the chapter adds completeness to this interesting chapter.

The tables prepared by the author are most valuable. He presents nine tables, *viz.*, "The Probable Useful Life of Various Articles," together with the authorities and a summary of the references; "Expectancy and Remaining Value." Two most useful tables to the valuation engineer. Six tables dealing with annuities and interest: (*a*) Amount of $1 at compound interest; (*b*) Present value of $1 due at a future date; (*c*) Amount of an annuity of $1; (*d*) The annuity which will amount to $1 in a given time; (*e*) The present value of an annuity of $1; (*f*) The annuity which $1 will purchase.

These tables are so arranged that they provide most satisfactory flexibility. In fact, in the writer's estimation they are far more efficient for the valuation engineer's use than any set of compound or interest tables that have yet come under his observation.

The remaining table—Amortization and Depreciation—adds completeness to the set and is an exceedingly useful table. The engineering profession in particular is indebted to the author for these most carefully worked-out and flexible tables.

The writer would like to suggest that the author publish the tables separately, *i.e.*, publish Chapter 14 complete. They would be more compact when travelling and would serve a wider range of usefulness if presented in this form.

In conclusion, the reviewer would say that this work is too far advanced for elementary students, but should prove useful for advanced students. It is particularly useful as a reference book for engineers and economists, and in fact, for business men in general. The tables alone will be found indispensable in most engineers' offices, and of considerable service in many business offices.

Parallel Tables of Slopes and Rises. By Constantine K. Smoley. Published by the McGraw-Hill Book Co., Inc., New York. First edition, 1917. 173 tables, 8 plates, 4¾ x 7 ins., flexible leather. Price, $4 net. (Reviewed by M. B. Atkinson, assistant chief draughtsman, Board of Engineers, Quebec Bridge, Montreal.)

This volume, consisting of about 345 pages, and divided into two parts, is issued as a companion to "Smoley's Parallel Tables of Logarithms and Squares."

Part I., consisting of about 262 pages, gives parallel tables of slopes and rises for levels, varying by sixteenths of an inch, from 1/16 inch in 12 inches to 12 inches in 12 inches.

Each bevel has a page to itself with a prominent heading at the top. The tables are given for bases, varying by sixteenths of an inch, from zero to 12 inches, and for bases varying by one foot, from zero to 40 feet. With these tables are given those for pitches of one-fifth, one-quarter, thirty degrees, and one-third. In these latter tables, the inch columns are extended to 32 inches, and the foot columns to 80 feet.

The answers are given to the nearest thirty-second of an inch but are so noted that they can be read to the nearest sixteenth of an inch. About 200 pages are devoted to these tables.

There are eight double-page plates, giving diagrams by means of which slopes, rises and bases for the various bevels in the tables can be read graphically. The bases start at 10½ inches and run to 24 inches, the rises from zero to 24 inches. The cross-sectioning gives direct reading to one-eighth of an inch.

Part II., consisting of about 76 pages, contains the following reprints from "Smoley's Tables":—

Parallel tables of logarithms and squares, varying by one thirty-second of an inch, from zero to 10 feet. A table of logarithms and squares by intervals of one sixty-fourth of an inch, from zero to 16 inches. Tables giving angles and natural and logarithmic functions, corresponding to bevels having a base of 12 inches and rises varying by one thirty-second of an inch, from zero to 12 inches. A multiplication table for rivet spacing, varying by one-eighth of an inch from 1⅛ inches to 6 inches, for spacing from 1 to 30. A table of decimal equivalents of a foot and an inch, for inches and fractional parts.

In the introduction, consisting of about 34 pages, the use and application of the tables and diagrams, is fully explained and examples are worked out. Sketches of a number of simple structural details are shown and the usefulness of the tables and diagrams demonstrated.

The contents of the volume are neatly arranged on good thin paper and well printed. The leather cover and binding gives a very flexible book of convenient size, which should wear well.

The usefulness of the book is self-evident from its title page. The accuracy of the tables are vouched for by Mr. Smoley's achievements in this line of work.

Any engineer who has had much to do with calculations, in which levels enter into, will value this book highly, and will appreciate what Mr. Smoley and his son have done to render this task much easier, with a reduction of the chance of error.

Electrical Equipment; Its Selection and Arrangement. By Harold W. Brown, Cornell University. Published by the McGraw-Hill Book Co., Inc., New York. First edition, 1917. 229 pages, 109 figures, 6 x 9¼ ins., cloth. Price, $2 net. (Reviewed by H. W. Price, Toronto University.)

This book is attractively unlike most electrical books in intention, contents and style. It is well adapted for its purpose—to aid non-electrical engineering students and mechanical engineers in applying electrical principles and data to industrial electric plants, shops, factories, mines, etc.

The work is most concise, liberally furnished with small, clear sketches and diagrams arranged to suit the text, and excellently covers a great range of engineering information. It deals with power plants and distribution systems, the fields covered by various types of system; the properties, uses and limitations of generators and motors, a.c. and d.c., converters, transformers, transmission lines, batteries and controlling equipment; regulating, protective and measuring apparatus, etc.; all in a brief yet detailed and interesting manner. Many typical problems are solved for the reader, and information is included on weights and costs. No space is wasted in reproducing catalogue cuts and the like, or in lengthy considerations of a few hobbies of an author. From cover to cover the book is filled with clearly stated information, combined with numerous references to further details in the Standard and American handbooks.

These two handbooks are mines of information to electrical engineers, but difficult for most mechanical engineers. The mechanical man who reads in "Electrical Equipment" a concise survey of the groundwork about his problem, will be better able then to appreciate those portions of the handbooks on the same subject, to which references are made.

PUBLICATIONS RECEIVED

City of Toronto.—Municipal handbook, 1917.

Province of Quebec.—Report on the mining operations in the province during the year 1916.

Ontario Railway and Municipal Board.—Eleventh annual report to December 31st, 1916.

Province of Quebec.—Report on the mining operations in the province of Quebec for the year 1916.

Department of Mines, Canada.—Summary report of the Geological Survey for the calendar year 1916.

Commission of Conservation.—Eighth annual report (1917) of the Commission of Conservation, Canada.

Highway Improvement in Ontario.—Annual report of the Ontario Department of Public Highways, 1916.

College of Mines, Houghton, Michigan.—Year book, 1916-1917. Contains announcement of courses for 1917-1918.

Canadian Society of Civil Engineers.—Transactions of the Canadian Society of Civil Engineers from January to June, 1917.

Province of Saskatchewan.—Report of the Department of Telephones for the financial year ended April 30th, 1916.

Water Power Commission, Province of Nova Scotia.—Progress report, covering the work of the Commission to September 30th, 1916.

Hydro-Electric Power.—Ninth annual report of the Hydro-Electric Power Commission of Ontario for the year ended October 31st, 1916.

How to Study.—By George F. Swain, LL.D. Published by the McGraw-Hill Book Co., Inc., New York. First edition, 1917; 65 pages. Price, 25 cents.

Board of Estimate and Apportionment.—Report of the New York City Board of Estimate and Apportionment for the year 1916. By Nelson P. Lewis, chief engineer.

State Highway Mileage and Expenditures.—Circular No. 74 issued by the United States Department of Agriculture, dealing with state highway mileage and expenditures for the calendar year 1916.

Activated Sludge Process.—Report made to the Board of Trustees of the Sanitary District of Chicago by Langdon Pearse and W. D. Richardson on the activated sludge process for handling Packingtown trade wastes.

Effect of Mouthpieces on the Flow of Water Through a Submerged Short Pipe.—Bulletin No. 96, Engineering Experiment Station, University of Illinois, Urbana, Ill., deals with the effect of mouthpieces on the flow of water through a submerged short pipe. By Fred B. Seely, Associate in Theoretical and Applied Mechanics.

Experimental Engineering.—By Langdon Pearse, division engineer, in charge of sewage disposal investigations, the Sanitary District of Chicago. This is a reprint from the J. E. Aldred lectures on engineering practice, 1916-17, and deals particularly with the construction of testing stations on water and sewage problems.

American Road Builders' Association.—Report of the proceedings of the fourteenth annual convention of the American Road Builders' Association held at Boston, Mass., February 5th to 9th, 1917, together with reports of the secretary and treasurer presented at the business meeting, list of members, etc. Published by the Association, 150 Nassau Street, New York City. Price, $2.

Bibliography on Ports and Harbors.—Compiled by William Joshua Barney, C.E., secretary of the American Association of Port Authorities, 110 West 40th Street, New York City. Contains 144 pages and gives a selected bibliography on ports and harbors, their administration, laws, finance, equipment and engineering. Price, $1.

As a result of the difficulty in getting the materials for rails, telegraphs and signals, it has been found impossible to complete the new underground railway in Copenhagen.

The effects of freezing and thawing on building stones are to be tested at the United States Bureau of Standards by means of an ingenious form of apparatus designed for the purpose.

According to a bulletin issued by the National City Bank of New York, the locomotives exported from the United States in the year ended June 30th, 1917, were estimated to number 1,290. and be of a value of $16,037,000, as compared with 799 of a value of $12,665,000 in 1916, and 228 of a value of $2,115,000 in 1915. Of steel rails there were, in 1917, 611,000 tons worth $26,632,000; in 1916, 540,000 tons of a value of $17,687,000, and in 1915, 159,000 tons, worth $4,537,000. In railway track material exported in 1917, the value was $8,164,000; in 1916, $5,261,000, and in 1915, $2,407,000.

Steady progress is being made in the United States towards the adoption of what has been agreed as standard voltages of electric supply—namely, 110, 115, and 120 volts. In June last 66 per cent. of the stations in the United States were operating at a standard voltage compared with 61 per cent. in March, 1916, but in Ohio the figures were 78 per cent. and 57 per cent. respectively. 45.6 per cent. of the stations in Ohio have adopted 110 volts, 30.2 per cent., 115, and 6.5 per cent. at 112 volts, while 4.6 per cent. operate at 220 volts, and only 2.0 per cent. at 120 volts.

The Canadian Engineer

Established 1893

A Weekly Paper for Canadian Civil Engineers and Contractors

Terms of Subscription, postpaid to any address:

One Year	Six Months	Three Months	Single Copies
$3.00	$1.75	$1.00	10c.

Published every Thursday by
The Monetary Times Printing Co. of Canada, Limited

JAMES J. SALMOND, *President and General Manager* — *ALBERT E. JENNINGS*, *Assistant General Manager*

HEAD OFFICE: 62 CHURCH STREET, TORONTO, ONT.
Telephone, Main 7404. Cable Address, "Engineer, Toronto."
Western Canada Office: 1208 McArthur Bldg., Winnipeg. G. W. GOODALL, Mgr.

PRINCIPAL CONTENTS OF THIS ISSUE

RECOGNITION OF THE ENGINEER

One of the chief complaints in the sphere of things technical is that good work or first-rate ingenuity goes unrecognized. It is not that direct reward is unbestowed but that successful efforts to solve difficulties are too much taken for granted. Underlying this grumble lies one of the fundamental basics of human nature which touches nearly every man in whatever sphere he creates,—the desire for an audience and the stimulation of praise.

It is to be feared that in many instances it is due less to a lack of understanding than to a fear that advantage will be taken, that appreciation is so rare. An artist, in whatever sphere, lives less by his own knowledge of good work accomplished than by the fact that others appreciate. It may, indeed, safely be said that lacking an audience there would be no art, as it is for the public more than the artist that the artist works. Creative work may be a hobby to satisfy individual expression but, failing appreciation, the artist starves, and even if this be not the case, his further efforts are penalized by reason of lack of appreciation. It is doubtful whether he can rise to the height of his powers unless early in his career he has secured some recognition.

In the engineering field, with its picked and critical audience, appreciation should be more common; too much is taken for granted and the facts go unrealized. As an instrument of increased production, a word of discriminating praise has a very real value. Some individuals cannot, perhaps, stand the treatment, and for this reason homeopathic doses are perhaps best. Not that this need be damnation with faint praise.

The artist and the engineer are both creators. Creative work is usually done by an individual to whom due appreciation means much. The fear that recognition must be tangible affects too many managers who forget that good work is the product of many factors, most of which are intangible. If blame is visited immediately and heartily on the head of a delinquent—and what manager is remiss in this particular?—then a word of appreciation to the competent is equally due, for many men are so constituted that such appreciation means more than a raise in pay. Usually a certificate as to character and ability filters through a second party, and while such indirect praise is better than none at all, when it is direct it is so much the better. More than one man has risen to heights he believed outside his capacity because he knew his chief believed in him and depended upon him for particular work. All men cannot, however, be treated alike and for this reason all systems where the men are simply pawns must lack in an essential human element. In actual practice even such systems get locally adjusted by the precise executive who, to get the best results, must invariably study his human material to handle it successfully. It is not necessarily the most able who can coordinate an engineering staff; it may be an intrinsically inferior mind, having a capacity for human assessment, who may be able to achieve the most.

The day of conscripted brutality has passed and there are none to mourn its passing. Intelligence in all ranks is at a higher level than was formerly the case; the newer conditions require newer methods, as the younger men in the profession are restive under former systems of control. A cheerful, appreciative chief gets cheerful and ungrudging assistance. This is, at all events, one result of recognition.

Handling men in bulk is a difficult business at best and requires unending patience, allowance and tact. More otherwise competent engineers fail for want of human appreciation of men than for almost any other one reason. Such knowledge is not taught in school nor is it easy of acquirement under any conditions.

Turning to another aspect of recognition, the engineer has up to the present failed to achieve due public recognition of his merits. As a class, their ability, commonsense, logic and abundant good qualities have never been advertised. The engineer is a shy and retiring individual. He does not placard himself abroad and is possibly content with his own field of effort. No other section of the community has quite the same collective experience in that much-abused term, "organization." He must be a man of honor in his work, for few other professions have quite the same responsibilities. While an operating surgeon's default is individual, as only one patient is in question, an engineer's default may be collective and involve hundreds in a single catastrophe. In addition, no other business employs so many men of high calibre, for the rank and file are highly skilled, enjoy the highest average manual wage and are essentially a picked class.

Why the engineer should be so little regarded as an administrative brain by the general public, it is difficult to understand. In the reassessment of values now imminent, it should be the policy of the profession that it be more directly represented in a public capacity. Such representation is in the public interest.

PERSONALS

R. McPhee has been appointed street superintendent of Waterford, N.S.

Hon. A. J. McLean, of Taber, Alberta, has been appointed minister of public works for that province.

Wm. Lancaster has been appointed a district inspector of mines for the province of British Columbia, with headquarters at Fernie.

Dr. C. J. O. Hastings, medical health officer, Toronto, was elected president of the American Public Health Association at the recent convention of the association held in Washington, D.C.

Frank Parrish, for many years assistant general purchasing agent of the American Bridge Co., Pittsburgh, has been appointed purchasing agent of the Canadian Steel Corporation, Limited, and will be located at Ojibway, Ont.

Flight-Lieut. W. H. R. Gould, a graduate of the School of Practical Science, Toronto, 1915, whose home is in Uxbridge, Ont., has been reported missing since September 26th. Lieut. Gould went overseas early this year with the Divisional Cyclists, transferring later to the Royal Naval Air Service.

Harry Bayne, of Hamilton, has been appointed by the Department of Trade and Commerce, Ottawa, as supervisor of metals and fibres. Mr. Bayne has a thorough knowledge of this work, having for many years been connected in Montreal with the Westinghouse Company and the National Car Company.

Hon. S. J. Latta, M.P.P., has been appointed minister of highways for the province of Saskatchewan, succeeding Hon. J. A. Calder, who has entered the Union Government at Ottawa, and Hon. Charles Dunning has been appointed minister of railways, in addition to the provincial treasurership, which he now holds.

Flight-Lieut. Conn Smythe, M.C., of Toronto, has been officially reported as missing. Lieut. Smythe, who is 22 years of age, was in his fourth year in engineering at the School of Practical Science when he enlisted in March, 1915, as a gunner. He obtained his commission in the following July, and left with his battery for overseas early in 1916.

Major Ian Sinclair, of Toronto, a student at the School of Applied Science, class 1917, has been awarded the Military Cross after continuous service since the beginning of the war. Major Sinclair went to England as lieutenant with the 13th Battalion (Montreal Highlanders), first contingent, being promoted first to captain and then major. He has been wounded four times and was mentioned in dispatches by Sir Douglas Haig last June.

OBITUARY

Ernest Belanger, B.A.Sc., M.Can.Soc.C.E., a member of the firm of Marion & Marion, Montreal, passed away on October 21st at the age of 54. A recent accident in which he had his leg broken, was the cause of death. For eight years Mr. Belanger was a director of the Polytechnic School and a professor there. In 1911 he was named a member of a Royal Commission to visit the chief European countries to study technical education. He was a member of the Quebec Streams Commission, a director of the Elder-Ebano Asphalt Company, and a member of the Engineers' Club.

ASSOCIATE COMMITTEES FOR SPECIAL RESEARCH

In order to increase the scope and efficiency of the work being done by the Advisory Council for Scientific and Industrial Research, the Council will appoint a number of associate committees to deal with various special subjects. Two special committees have already been formed, one in connection with the chemical industries, the other with mining and metallurgy. Each of these committees consists of twenty members, with special qualifications for looking after the industries of Canada in these two important fields.

It is also announced that the Council has taken over from the Arthur D. Little Company, on behalf of the government, the natural resources survey which this company has inaugurated. The work will be continued by the Council on a much more extended scale, in co-operation with the various government departments.

ADVISORY COUNCIL ON SCIENTIFIC RESEARCH AWARDS STUDENTSHIPS

The Advisory Council on Scientific and Industrial Research has recommended the government to establish twenty studentships and, for more advanced students, five fellowships, to be awarded to young men who have already completed their preliminary scientific training in our universities or technical colleges and who show a special ability in research. The following awards have already been made:—

Studentships—W. H. Hatcher, B.A., McGill University; R. J. Clerk, B.A., McGill; H. H. C. Ireton, M.A., University of Toronto; J. F. T. Young, M.A., Toronto; O. J. Bridgeman, B.A., University of Saskatchewan; R. Hamer, M.A., Toronto.

Fellowships—A. D. Hone, M.A., University of Toronto; A. J. Walker, B.A., University of Saskatchewan; Geo. H. Henderson, M.A., B.Sc., Dalhousie University.

CONCRETE SHIPS IN SCOTLAND

United States Consul H. Albert Johnson, at Dundee, Scotland, wrote under date of September 4th, 1917, to the Department of Commerce at Washington, D.C., as follows, the letter being published by the department in its October official "Commerce Reports":—

"According to the daily papers of this city a letter has recently been received by the Dundee Harbor Trust from the Caledon Shipbuilding Co., in which it was stated that the offer by the Harbor Trust of a building site for the construction of concrete ships was accepted. This site is to include approximately 14 acres, situated near the fish docks, and will be put in condition by the Harbor Trust immediately for the commencement of work on the building of the shipyard by the Caledon Co.

"This announcement has excited the liveliest interest in shipbuilding circles. The Harbor Board has suitable grounds at its disposal on the water front which it can offer to the promoters of this new venture. In the opinion of a local expert in shipbuilding, there is a strong probability that the building of concrete vessels will not prove to be merely a temporary makeshift, but that, provided they fulfil the expectations of shipbuilders, they are destined to hold an important place in the future of the maritime commerce of the world."

Coast to Coast

Amherstburg, Ont.—Work on the construction of the new Brunner-Mond of Canada, Limited, plant, near here, is being rushed to completion with all possible despatch. This company is a branch of the Solvay Process Co., of Detroit. When this plant is completed, it will be one of the largest single industries in Western Ontario.

Campbellville, Ont.—Murray Crawford has taken lease on oil limits, and has installed machinery for drilling operations.

Cobalt, Ont.—S. Yamaki, mining engineer and superintendent of the Tsudo Copper Mine at Ashio, Japan, was here for several days recently studying the mining and milling methods in vogue in this camp. He was accompanied by H. Toyoda, also a mining engineer, and while here these gentlemen made themselves acquainted with the professional practice at Cobalt. This is probably the first time that mining engineers from Japan have come to Canada merely to learn and to get a wider experience and a better understanding of their profession. They also visited Porcupine.

Erieau, Ont.—Work on the huge new coal hoist being erected here is proceeding rapidly, and it is expected that it will be in use early in November. The new equipment will have a much larger capacity than the old hoist, which was wrecked recently.

Galt, Ont.—Commissioner George E. Fisher, of the local Hydro-Electric Commission, is advocating the formation of a Public Utilities Commission in Galt, to administer the Hydro, waterworks and parks. He introduced a motion recommending the change at a meeting of the Hydro Commission, and it will be sent on to the Council. The motion calls for the question to be voted on by the people in January.

Hamilton, Ont.—A new company, to be known as "J. B. Nicholson, Limited," has been incorporated. The authorized capital is $40,000, head office is in Hamilton, and provisional directors, ex-Alderman William Nicholson, John H. Clappison, of the Hamilton Engine Packing Company, and J. B. Nicholson, B.A.Sc., A.M.Can.Soc.C.E. The nature of the business to be carried on by the new firm is to be general engineering construction, a specialty being made of building a new design of large reinforced concrete tanks.

King's County, N.B.—Considerable road improvement work is being carried on here. Auto trucks and road gangs are at work in different sections of the county and many roads are being widened and gravelled.

Lethbridge, Alta.—That Lethbridge may expect a building boom next spring in spite of the high prices of materials is the general trend of opinion. There is some talk of a number of down-town blocks being built.

Montreal, Que.—A bill will be introduced in the Provincial Legislature, when it meets in December, to order the annexation to Montreal of Westmount, Maisonneuve, Outremont, Verdun, and of Montreal East, a small municipality near Mercier ward in the east end.

Montreal, Que.—The prevailing high prices of hematite iron ore of good quality has stimulated this class of mining in Quebec and Ontario. One of the companies recently incorporated is the Canadian Union Iron Mines Corporation, Limited, with a capital of a million dollars, and head office in this city, who intend opening their deposits near Sutton, Quebec, where hematite iron ore has been uncovered analyzing 68 per cent. metallic iron. This company has already started work on another mine near Perth, Ontario, from which it is said there were several thousand tons of iron ore taken several years ago.

Newmarket, Ont.—The new concrete bridge on Huron St., adjoining the Grand Trunk station, is complete all but the finishing touches, and will probably be open for traffic this week.

North Vancouver.—The City Council empowered Mayor Vance to continue his efforts in urging upon the Dominion Government the claims of the North Shore for a dry dock.

Ottawa, Ont.—Plans of the Power Development Company to dam the St. Lawrence at the Coteau Rapids have been referred to the district engineers of the Public Works Department at Montreal for a report upon the engineering features of the proposition. This is in the natural order of routine in dealing with such matters. In view of the opposition which has been aroused, Government approval of the plan is exceedingly improbable. In any event, however, power schemes on international waters have to secure the sanction of the International Joint Commission.

Ottawa, Ont.—The exportation from Canada of silver spruce (except under license) has been prohibited to all destinations abroad other than the United Kingdom, British possessions and protectorates.

Port Arthur, Ont.—The City Council has sent a communication to Sir George E. Foster asking him to have the plant and mines of the Atikokan Iron Company, which at present are not in operation, in this city, operated under government supervision, owing to the embargo which the United States has placed on iron and steel coming to Canada.

Quebec, Que.—A special train with a number of guests of the St. Lawrence Bridge Company crossed the new Quebec bridge from shore to shore at noon on October 17th. All went well. The company announced that the first freight train will run over the bridge some time in November. The official opening will not take place until next spring.

Sarnia, Ont.—The new 410 k.v.a. motor, purchased to drive the generator for the supply of power for the Sarnia Street Railway Company, and which has been in process of erection at the hydro sub-station for some time, has been finally installed and is now being used to operate the cars.

Sarnia, Ont.—The paving contractors on the London Road have completed their work and the whole pavement will be thrown open to the public in a few days, when the concrete has had time to harden.

Smooth Rock Falls, Ont.—The new plant of the Mattagami Pulp & Paper Co. has been completed.

St. Catharines, Ont.—Owing to shortage of natural gas in the district, the City Council decided to raise the price of the supply from its municipal plant from seventy-five cents to $1 per thousand feet. The Council also passed a resolution requesting the Government to grant the Hydro-Electric Power Commission further power to increase its supply.

Stouffville, Ont.—Rapid progress is being made on the erection of the new six-roomed Public school, and it is expected that it will be opened in February of next year. Between $30,000 and $40,000 is the estimated cost of the fine new building.

Stratford, Ont.—A deputation from the Light and Heat Commission of St. Mary's visited the city's power plant and the waterworks.

Toronto, Ont.—In all probability the Don Section of the Bloor Street viaduct will be ready to be handed over to the city on October 25th, according to a statement made by T. T. Black, engineer in charge for the contractors, Quinlan and Robertson. All that will then remain to be done to make this section ready for use will have to be done by the city.

Victoria, B.C.—That there will be further delay in the negotiations between the city and the Esquimalt & Nanaimo Railway over the construction of the proposed Johnson Street bridge was made clear recently, when Mayor Todd was informed that the railway company will make no reply to the city's proposal of August 8th, but will try to find out whether the Dominion Board of Railway Commissioners has any jurisdiction in the issue between the city and the railway.

Winnipeg, Man.—Satisfactory progress is being made with the hydro-electric work at Point du Bois, and the contractors claim that they are up to schedule in the work, which will be continued all winter. It is expected that the contract will be completed by about the first of September of next year. This will mean that by that time the power generated will be approximately 48,000 horse power. This increased production will supply the city's needs for current for many years.

Winnipeg, Man.—The judges' report and the announcement of prize winners in the 1917 dragging competition was made at a special meeting of the Manitoba Good Roads Association. Arrangements were also completed for the annual banquet to be held on November 14th. A committee was appointed to work out a scheme for 1918 for a special competition, covering the entire province, for which the Provincial Government will present a championship trophy.

Construction News Section

Readers will confer a great favor by sending in news items from time to time. We are particularly eager to get notes regarding engineering work in hand or projected, contracts awarded, changes in staffs, etc.

▲—Denotes an item regarding work advertised in *The Canadian Engineer*.
+—Denotes contract awarded. The names of successful contractors are printed in CAPITALS.

ADDITIONAL TENDERS PENDING

Not Including Those Reported in This Issue

Further information may be had from the issues of *The Canadian Engineer* to which reference is made.

PLACE OF WORK	TENDERS CLOSE	ISSUE OF	PAGE
New Glasgow, N.S., erection of building	Oct. 30.	Oct. 18.	46
Regina, Sask., erection of building	Oct. 26.	Oct. 18.	46
Toronto, Ont., miscellaneous supplies	Oct. 30.	Oct. 18.	56
Toronto, Ont., miscellaneous work on schools	Oct. 25.	Oct. 18.	48
Vancouver, B.C., drainage system	Oct. 26.	Oct. 18.	50
West Oxford Tp., Ont., construction of drain	Oct. 29.	Oct. 18.	46
West Oxford Tp., Ont., construction of drain	Oct. 29.	Oct. 18.	50

FACTORIES AND LARGE BUILDINGS

Arnprior, Ont.—Tenders are being received by the architects, Richards & Abra, 126 Sparks St., Ottawa, for the erection of a one-story, concrete and brick factory for the Arnprior Cabinet Co., Ltd.

Beauharnois, Que.—The Independent Silk Co., Ltd., 52 Nazareth St., Montreal, plans erection of a factory. Architect, G. A. Monette, 83 Craig St. W.

Big Valley, Alta.—Sealed tenders will be received by the Board of Trustees, School District No. 3338, Ewing P.O., at the office of Ed. W. Adstead, secretary-treasurer, up to noon, October 31st, 1917, for the erection of a frame school building. Plans and specifications may be obtained from the Secretary-treasurer.

+—**Cobourg, Ont.**—A. L. JEX & CO., College St., have been awarded the general contract for two-story brick addition to dyeing plant for the Cobourg Dyeing Co., Ltd., William St.

Coronation, Alta.—Sealed tenders will be received by the Board of Trustees, School District No. 2926, Coronation, Alta., at the office of Henry Thompson, secretary-treasurer, up to noon, November 10th, 1917, for the erection of a frame school building. Plans and specifications may be obtained from the secretary-treasurer.

Edmonton, Alta.—The Alberta Farmers' Co-operative Elevator Company will start work at once on erection of elevator in this city.

Fergus, Ont.—A movement is on foot by the local Board of Trade to have the Monkland mill, owned by James Wilson & Sons, and recently destroyed by fire, rebuilt.

Fergus, Ont.—It is reported that a site has been chosen near Fergus for a new Military Tuberculosis Sanatorium, "D Unit." Address, Prof. W. H. Day, O.A.C., Guelph.

+—**Gagetown, N.B.**—General contract let to M. A. CONDON, Water St., Digby, for the erection of station houses costing $12,000 for the St. John & Quebec Railway Company, between here and Westfield.

Galt, Ont.—R. Hall, Barrett-Martin Block, Water St. N., is preparing plans for $10,000 brick isolation hospital for the City Council.

Halifax, N.S.—C. C. Blackader, Granville St., plans erection of concrete and brick offices.

Les Cires, Que.—Work has started on the construction of a frame station for the Canadian Pacific Railway, Windsor St., Montreal. Estimated cost, $5,000.

Maple Ridge, B.C.—Municipal Council plans erection of municipal hall. Clerk, L. G. Raynor.

+—**Moncton, N.B.**—AMBROSE WHEELER, 51 Railway Ave., has the general contract for $4,500 one-story concrete and brick warehouse for the Imperial Oil Co., Downing St.

+—**Moncton, N.B.**—The Humphries Glass Works let contract for the erection of their new building to AMBROSE WHEELER, of Moncton.

+—**Ottawa, Ont.**—ALEX. GARVOCK, 136 Lewis St., has the general contract for $8,000 two-story concrete and brick ice plant for the Ottawa Dairy Co., Somerset St.

Ottawa, Ont.—The Department of Public Works, Dominion Government, contemplate the erection of an abattoir in the Maritime Provinces. Secretary, R. C. Desrochers.

Ottawa, Ont.—The Ottawa Valley Motor Car Association contemplate alterations to their club house. Secretary-treasurer, A. A. Dion, 35 Sparks St.

Port Credit, Ont.—Town Council plans erection of new municipal building. Estimated cost, $3,000. Clerk, Frank W. Ott.

Quebec, Que.—A. R. Simms, of Montreal, vice-president of the Delaware & Hudson Railway, recently visited this city, to look over a suitable site for the erection of a Delaware and Hudson Railway terminal here.

+—**Sarnia, Ont.**—The Northern Hotel stables, which were purchased some time ago by the city for market purposes, are being rebuilt by GUTTERIDGE & GRACE. The improvements when completed will cost about $5,000.

+—**Sarnia, Ont.**—Work on the construction of the branch factory of the Mueller Manufacturing Company in the city of Port Huron is now under way, and the contractors are making splendid progress on the foundation work. A 900-foot concrete roadway is now being constructed, and foundations for three other buildings will soon be laid. The contracts for the buildings have not yet been awarded, but the foundation work is being rushed by JAMES O'SULLIVAN & SONS CO.

+—**Sault Ste. Marie. Ont.**—The Algoma Steel Corporation has awarded a contract for six Gunite buildings to be erected by the Cement-Gun method, to the BURNS CEMENT-GUN CONSTRUCTION CO., LTD., Toronto.

Scott, Sask.—Hospital Board plans extension to hospital building. Chairman, Dr. Cooper, Main St.

+—**Semans, Sask.**—Contract let to SMITH BROS. & WILSON, LTD., Eighth and Ottawa Sts., Regina, for erection of $10,000 brick school.

Ste. Anne de Bellevue, Que.—Tenders will be received until November 1st for the erection of a $200,000 limestone and plastic brick hospital for the Military Hospital Commissioners, Drummond Bldg., Montreal.

St. Catharines, Ont.—Sealed tenders will be received, addressed to the Chairman of the Finance Committee, City Buildings, up to 5 o'clock of Friday, October 26th, 1917, for the wrecking and removal of several buildings on St. Paul Street. Information regarding the work may be obtained at the office of W. P. Near, City Engineer.

Edmonton, Alta.—A permit has been issued to the Imperial Oil Company for the erection of a brick warehouse on 121st Street. Estimated cost, $12,000.

Edmonton, Alta.—The United Grain Growers have commenced the erection of their 35,000-bushel grain elevator on 102nd Street. It is expected that the work will be finished in a month.

Hastings, Ont.—The plant of the Hastings Tanning Company was completely destroyed by fire. Loss, $200,000. The Breithaupt Co., of Kitchener, controls the company.

Lethbridge, Alta.—It is reported that the C.P.R. has decided to erect a new building for the Dominion Express Co. The station building will also be remodelled.

Montreal, Que.—The warehouse of the Black River Paper Mills, owned by the J. R. Walker Company, was damaged by fire. The loss will be several thousand dollars.

New Toronto, Ont.—Ratepayers will vote at the January elections on a by-law for the purchase of two school sites.

Pembroke, Ont.—Representatives of the Waterous Engine Co., of Brantford, have been in Pembroke lately, preparing plans for the enlargement of the Petawawa Lumber Co.'s mill, which will be used temporarily by the Colonial Lumber Co., or until such time as conditions are favorable for the erection of a large new mill by that company.

+—Regina, Sask.—Contract let to the McKAY CONSTRUCTION CO., at a figure approximating $5,000, for an additional story to the warehouse occupied by the Canada West Electric, Ltd., on Osler Street North. Brick construction.

Sarnia, Ont.—W. A. Brown will rebuild ice houses recently destroyed by fire.

+—Shawinigan Falls, Que.—TREPANIER & BELLEFEUILLE, Three Rivers, have the general contract for $50,000 convent for the Roman Catholic Commissioners.

Staplehurst, Alta.—Sealed tenders will be received by the Board of Trustees of Staplehurst, Alta., School District No. 3511, at the office of Frederick H. Dunstan, secretary-treasurer, Lloydminster, Sask., up to noon, November 3rd, 1917, for the erection of a frame school building. Plans and specifications may be obtained from the secretary-treasurer.

+—St. Mary's, Ont.—WILLIAM HEUTHER, care of chairman of the Light Commission, Mr. Richardson, has the cement block contract for addition to power-house for the Town Council.

St. Thomas, Ont.—Plant and stock pens owned by the St. Thomas Packing Company, destroyed by fire. Loss, $10,000.

Toronto, Ont.—A building permit has been issued to the Toronto Hosiery Co. for a factory addition at 1103 Queen St. West, to cost $1,600.

Toronto, Ont.—A factory building is being erected on Osborne Street for John W. Hand.

Toronto, Ont.—John Laughlin, 249 Bellwoods Avenue, will erect a $30,000 three-story brick and concrete garage.

Toronto, Ont.—New tenders will be called for the erection of three lavatory buildings costing $35,000, for the Canadian National Exhibition Board, 38 King E.

Toronto, Ont.—Owing to the Minister of Education's decided stand against three-story school buildings, Chief Inspector Cowley, of the Board of Education, has recommended that the Board consider the practicability of a two-story building with a one-story wing or annex on each of the new sites for Alexander Muir, Perth, Queen Alexandra, Glenholme, Glengrove schools, plans of which were approved by the committee some time ago.

Toronto, Ont.—Permit issued to the Palmolive Soap Co., for erection of a metal power house on the north side of Natalie St., near Carlaw Ave., to cost $3,000.

Toronto, Ont.—The City Architect issued the following building permits:—Toronto Carpet Manufacturing Co., addition to boiler house, 1179 King Street West, $2,500, and Toronto Electric Supply Works, alterations to factory building, east side of Hanna Avenue, near King, $3,000.

Toronto, Ont.—The Dominion Bank, head office, King and Yonge Streets, plans erection of stone and brick bank building on Walker and Yonge Sts.

Toronto, Ont.—Work will be started shortly on the erection of a solid brick garage and large public hall on the corner of Shaw Street and West St. Clair Avenue by J. Barnett.

Unionville, Ont.—Ratepayers plan erection of a town hall and a public market hall.

+—Uxbridge, Ont.—H. R. SHELDON, Lefroy, has the general contract and will sublet smaller trades for $10,000 two-story brick bank for the Sterling Bank of Canada.

Victoria, B.C.—Permission to erect a smoke-house at 1302 Wharf Street has been granted to Burdick Bros. & Brett, Ltd.

+—Walkerville, Ont.—The following contracts have been awarded in connection with the erection of a $16,000 forge shop for the Dominion Stamping Co.:—General contract, masonry and carpentry, WELLS & GRAY, Bank of Commerce Bldg., Windsor; steel, CANADIAN BRIDGE CO., Walkerville; roofing, JOHNS-MANVILLE CO., Detroit, Mich.; sash, TRUSSED CONCRETE STEEL CO., Walkerville; painting, C. M. BENNET, Walkerville.

Weston, Ont.—Town Council is considering making additions to the Town Hall. Clerk, J. H. Taylor.

BRIDGES, ROADS AND STREETS

Bitter Lake, Sask.—Provincial Department of Public Works, Regina, plans erection of an $18,000 2,000-foot lumber bridge.

Brantford, Ont.—Immediate action has been demanded by Mayor Bowlby on the part of the L. E. and N. Railway in the matter of widening Water Street, as ordered by the Dominion Board of Railway Commissioners.

Cobalt, Ont.—The T. & N. O. Railway Co. are building a steel and concrete bridge over the White Clay River.

Cornwall, Ont.—By a vote of 18 to 14 the Counties Council of the united counties of Stormont, Dundas and Glengarry, decided to defer action until the January session on the matter of closing the good roads scheme. The tenders in the hands of the road committee, twenty-three in number, were rejected, and new ones will be called for by the council.

Dunnville, Ont.—Town Council passed a by-law to provide $5,000 for the construction of certain pavements. Clerk, J. W. Holmes.

East Toronto, Ont.—A brick roadway is to be laid on Kingswood Road from North Queen Street to Kingston Road.

Hamilton, Ont.—City Council plans construction of cement sidewalks and curbs on Roxboro, Wexford and Belview Avenues. Estimated cost, $3,000. City engineer, E. R. Gray.

London, Ont.—City Council intends to construct an asphaltic concrete pavement on Ardaven Place, estimated to cost $4,322.88, also several cement curbs and gutters. City engineer, H. A. Brazier.

Moncton, N.B.—City Council decided to pave Bonaccord Street from Main to Gordon with Warrenite. City engineer, J. Edington.

Montreal, Que.—Board of Control recommended that the sum of $20,000 be voted for repairs to Lachapelle bridge. City engineer, Paul E. Mercier.

Montreal, Que.—Board of Control adopted a report providing $9,000 for repairs to the pavement in St. Antoine St. City engineer, Paul E. Mercier.

Niagara Falls, Ont.—City Council decided to construct a concrete pavement with tarvia top on Walnut Street. City engineer, W. C. Jepson.

Oakland, Man.—The Municipal Council contemplates the construction of about sixty miles of highway. Clerk, W. T. Johnston, Wawanesa.

+—Ottawa, Ont.—Department of Public Works, Dominion Government, let contract to O'LEARY'S, LTD., Bank